

DISSERTATION ABSTRACTS

*ABSTRACTS OF DISSERTATIONS AND
MONOGRAPHS IN MICROFORM*

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INTRODUCTION

This year for the first time *Dissertation Abstracts* will carry, as the 13th issue of Volume XVI, an index to all doctoral dissertations published in the United States and Canada. This issue will be titled *Index to American Doctoral Dissertations*, and will be a continuation of *Doctoral Dissertations Accepted by American Universities*.¹ The joining of these two reference works makes it possible for librarians to have an integrated bibliographical research tool relating to doctoral dissertations under one cover.

Dissertation Abstracts will continue to provide abstracts of dissertations by recipients of doctoral degrees from graduate schools cooperating with University Microfilms in the publication of complete dissertation texts on microfilm, on Microcards, or as microprint. At the end of each abstract will be found an indication of the number of pages in the original typescript and the Library of Congress card number, for the convenience of scholars and research workers. In some instances *Dissertation Abstracts* will be found to be an adequate substitute for the published dissertations.

The *Index to American Doctoral Dissertations* will be a complete indexed listing of dissertations by students who were granted doctoral degrees during the previous academic year, and including those abstracted in *Dissertation Abstracts*, arranged by degree-granting institutions under appropriate subject headings. An alphabetical author index will be included.

The tabular material which has been an established part of its predecessor volume will be included in full, so arranged that statistical summaries can be maintained with no break in continuity.

It is hoped that those who use *Dissertation Abstracts* will continue to make suggestions for its improvement, as these are vital to its continued life and growth. Several suggestions for changes in the headings used for indexing purposes have been received, and a committee of the Association of Research Libraries is reviewing the indexing system at the present time as a result of these suggestions.

¹Arnold H. Trotter and Marian Harman, (eds.), *Doctoral Dissertations Accepted by American Universities*. (New York: H. W. Wilson Co., 1933-1955.)

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AGRICULTURE

AGRICULTURE, GENERAL

MOISTURE AND OTHER ENVIRONMENTAL FACTORS IN RELATION TO THE CONTROL OF NEMATODES BY FUMIGATION, WITH SPECIAL REFERENCE TO THE GOLDEN NEMATODE

(Publication No. 15,600)

Martin Bernard Harrison, Ph.D.
Cornell University, 1955

In this study, further evidence is presented of the manner in which moisture and temperature affect the control of nematodes by soil fumigants. The control materials 1,2-dichloropropane and 1,3-dichloropropene, trichloronitromethane, 1,2-dibromoethane, and sodium N-methyl dithiocarbamate dihydrate were used in tests conducted with the nematodes *Heterodera rostochiensis* Woll., *Meloidogyne* sp., *Xiphinema* sp. and *Turbatrix acetii* (Muller) Peters.

Encysted golden nematode larvae were fumigated in glass chambers under controlled temperature and relative humidity conditions. There was no significant difference in the degree of control achieved with any of the nematicides at 10°C, 20°C, or 30°C. The degree of control was in direct proportion to the relative humidity at the time of fumigation. The maintaining of encysted larvae at a high relative humidity for two weeks prior to fumigation increased the efficiency of the treatment.

The lateral diffusion of D-D mixture and EDB (W-85) was studied in two soils having different moisture equivalents. A series of tests at two moisture contents and at 70°F and 85°F showed that both root-knot and *Xiphinema* nematodes were controlled at a greater distance from the point of injection at the higher soil temperature. Neither the soil moisture equivalent nor the moisture content were as significant as the temperature to the degree of control obtained in these experiments. EDB (W-85) diffused further than D-D mixture at the same dosage rate.

A method is described in which the vinegar eelworm was used to determine the rate of evolution of nematicides from fumigated soils. In these tests, the soil temperature influenced the evolution of the nematicides in a positive direction.

In soil naturally infested with golden nematode cysts, D-D mixture was more effective when injected to a depth of 5 inches than 3 inches, at a soil moisture content which was well suited for the control of the nematodes. In all cases, a water seal increased the amount of control.

Encysted golden nematode larvae, which had been stored at 10 per cent, 50 per cent or 100 per cent relative humidity, were fumigated in both dry and moist surface layers of soil. Control of all encysted larvae buried in the moist layer of soil was significantly greater than those in the dry layer of soil. Encysted larvae stored at the highest relative humidity were more susceptible to the fumigant in the dry layer of soil than those stored at the lower relative humidities.

The kill by D-D fumigation of larvae in newly developed golden nematode cysts was significantly less than that of larvae in cysts which were from one to several years old.
92 pages. \$1.15. Mic 56-302

MARKETING SOUTHEASTERN EARLY IRISH POTATOES

(Publication No. 15,492)

Joseph Myron Johnson, Ph.D.
Cornell University, 1955

Chairman: Dr. M. P. Rasmussen

Potatoes from five South Atlantic states were followed from harvest, through commercial channels, into wholesale markets and retail stores to determine: (1) why quality changed, and (2) marketing methods, equipment, and costs or charges.

Eight defects, troublesome in one or more areas were present before marketing started, contributing to lower quality and quality changes during marketing.

Defoliation was used increasingly to facilitate harvest, control harvesttime foliage disease tuber infection, promote maturity, and control tuber size.

Careless digger adjustment and fast digging caused the majority of shipping point mechanical damage. Wire pick-up containers contributed many minor mechanical defects. Poor coordination of harvest with grading allowed desiccation damage to potatoes overexposed to rapid drying conditions.

Itinerant labor contractors and truckers commonly picked up and hauled potatoes to packing sheds. Costs, commonly based on field containers involved, varied with contract rates, weight placed in field containers, and percent gradeout in culls.

Lack of storage space for field run potatoes caused delay in unloading trucks and desiccation and heat injury to potatoes in exposed sacks. Potatoes in 25 of 31 packing sheds were washed. Washed potatoes were hot-air dried in 17 packing sheds. Comparisons of spoilage in washed potatoes dried or not dried before shipment showed no benefit from drying.

Careless handling, long drops, and lack of padded equipment caused avoidable mechanical injury in packing sheds. Uniform feeding, equalization of defects passing grading personnel, comfortably arranged well lighted picking tables, and adequate supervision with limited working hours for grading personnel would contribute to effective grading.

Packing shed costs varied with variation in services, volume, type of shipping containers, and investment and rate of depreciation for plant and equipment. Custom packers charged five cents per hundredweight more than owner-operator estimated costs for similar services.

Washing potatoes and drying with hot air cost 2.7 to 7.7 cents per hundredweight more than dry grading.

Trucks have rapidly replaced railroads in potato shipments primarily because of their shorter time en route for prices and quality to change and flexibility of delivery in city markets. Change was limited by variability in interstate truck regulations.

Most shipments were unrefrigerated. Those refrigerated were usually precooled or initially iced. Temperatures below 70° F. reduced decay and disease development but increased weight loss and desiccation. Better information on post-grading commodity condition could direct selection of proper protective services.

Transportation charges were similar for railroad and truck shipments. However, protective services and miscellaneous market charges were more common with railroad shipments.

Independent dealers, purchasing and selling potatoes for their own account; commission merchants selling consigned shipments for shippers' accounts; and chain store warehouses, receiving and distributing shipments for member stores received carlot and trucklot shipments of potatoes. Although independent dealers sometimes could not recover commodity costs in selling price, their margins averaged approximately commission charges. Chain store warehouse margins were slightly lower.

Retailers regarded these potatoes as highly perishable, purchasing in small quantities at frequent intervals. Most retail displays were in bulk. Some stores used store bags, preventing customers from picking over displays. Retail margins were mostly between 25 and 39 per cent of the retail price, although extreme margins ranged from 7.2 to 48.7 per cent.

Cuts and bruises accounted for from 48 to 75 per cent of the defects in a variety in the retail displays, emphasizing need for reducing mechanical damage. With desiccation damage and insect damage they comprised from 85 to 93 percent of the defects. 212 pages. \$2.65. Mic 56-303

PLOT TECHNIQUE STUDIES WITH SPINACH

(Publication No. 15,518)

Joe McFerran, Ph.D.
Cornell University, 1955

A uniformly treated field of America spinach was used in a study conducted to estimate the optimum size and shape of plot and to evaluate the relative efficiency of certain lattice designs. Six rows of spinach were planted one foot apart on beds that were 7 feet wide. A total of twenty-three hundred and four plots, each 2 feet long and 3½ feet across the row were used. These were harvested from an area 48 feet wide and 104 feet long. Each 2-foot plot was made up of the three rows on either side of the seven-foot bed. The basic plots were added together to form plots of different sizes and shapes.

Analysis of the data was made to obtain the between-plot variance using standard I.B.M. equipment. From this a coefficient of variability was computed for each plot assuming both constant replication and increasing area, and constant area and decreasing replication. In addition the variance of yield per unit area was obtained for each

plot size by dividing the between-plot variance by the number of basic units making up each plot size. The regression of the logarithm of the variance per unit area on the logarithm of plot size was then obtained.

When the coefficients of variability were plotted against plot size in units, the optimum size of plot was 4 to 6 basic units when constant replication and increasing area was assumed. With constant area and decreasing replication a plot of the coefficients of variability showed the basic plot to be the most efficient in reducing variability. The fallacy of obtaining an optimum plot size under these two assumptions was pointed out.

The regression of the logarithm of yield per unit area (V_x) on the logarithm of plot size was -.3978. Estimates of percentages of costs due to the number of plots per treatment (k_1) and the percentage due to area per treatment (k_2) were made. The estimated cost of k_1 was 65.53 and 34.47 for k_2 . The use of these values in the formula proposed by Smith (1938) gave an optimum size of plot of 1.26 basic units.

The use of certain incomplete block designs gave small gains in efficiency over randomized complete blocks when 16, 25, and 56 varieties or treatments were compared. The gains ranged from 3.1 per cent to 17.5 per cent. Balanced lattices were only slightly superior to simple and triple lattices. Increasing the size of the plot increased the efficiency of the balanced design only slightly.

65 pages. \$1.00. Mic 56-304

APPLICATION OF ECONOMIC THEORY TO FARM RECORD ANALYSIS

(Publication No. 15,248)

Allan George Mueller, Ph.D.
University of Illinois, 1955

Farm management is defined as the field of study which considers the efficient organization and operation of farm firms with the objective of securing the maximum continuous profits consistent with the welfare of the farm family. The field of study includes intrafirm, interfirm, and inter-regional relationships of resource efficiency and productivity. Economic theory of the firm provides the conceptual framework for the orientation of the decision problems of farm operators and suggests logical methods for analysis and criteria for evaluating optimum solutions.

The purpose of this dissertation is to relate the application of economic theory to the use and analysis of farm record data by individual farmers and research workers in the field of farm management. The early development, present techniques, and problem areas of farm record analysis are outlined. Business accounting methods are compared and related to farm accounting methods. The firm-household relationship of family farming presents accounting problems in pricing family resources used by the farm firm. Business accounting procedures need to be modified to meet requirements imposed by joint activity relationships and multienterprise systems of farming.

The analytical phase of the investigation centers on the use of farm record measures of over-all farm efficiency and farm income. The process of imputing market prices on the labor and capital resources of the household is tested, using estimated marginal productivities of labor

and capital calculated from a mathematical production function. Results suggest that farm record measures are influenced by errors in the imputation process.

Farm record measures are also related to economic theory of the firm. The implied goal of maximizing a farm record measure is not consistent with profit maximization theory of the firm. Level of resource use is different for maximization of a farm record measure and maximization of profits. An exception to this relationship is noted for the farm record measure of "management returns." Maximization of this measure is consistent with economic theory.

Farm record measures are related to a management residual calculated from a production function. The calculated management residual avoids the imputation and residual claimant methods used in conventional farm accounting procedures. Apparent biases are noted in ratio measures, particularly where different resource combinations are employed on different farms. The interpretation of a ratio measure, reflecting output per unit of input, from a farm account record is not clear. When compared with other farms, a high ratio measure may result from a more advantageous production function, a different level of resource inputs, or a combination of both situations.

The investigation of farm record uses was undertaken with the view that a synopsis of the development, problems, and interpretation of farm record materials will provide a better understanding of the functions of farm accounting. Three groups of persons that may benefit from this investigation are identified as (1) individual farmers who keep a systematized set of farm accounts, (2) research workers who use farm record data, and (3) other persons concerned with the organization and operation of farm firms.

153 pages. \$1.91. Mic 56-305

FORAGE PRODUCTION AND USE IN THE CENTRAL PLAIN REGION OF NEW YORK

(Publication No. 15,502)

William Wallace Peek, Ph.D.
Cornell University, 1955

Chairman: L. C. Cunningham

This study is concerned with the examination and description of cropping patterns involving sod crops, uncultivated crops, mostly small grains, and row crops. The use of forage and feed grains by livestock in the area is also investigated.

Data for this study are from a farm management survey in 15 counties in western New York. The survey is based on a 10 per cent sample of commercial farms randomly distributed over the Central Plain Region.

Three types of farms, dairy, mixed, and crop, are considered with respect to use of cropland, forage and feed crops and animal units of roughage-consuming and grain-consuming livestock. Financial information including labor income is also presented. Average labor income for crop farms in 1953-54 is moderately higher than for dairy farms. For mixed farms average labor income is significantly lower than for the other types of farms.

Crop yields for the Central Plain Region are about 25

per cent higher than for the state as a whole. Yields vary among the nine major soil associations.

In a study of the effect of sod crops on yields of other crops it is evident that little increase in crop yields can be attributed to an increase in the proportion of sod crops in rotations unless commercial fertilizer applications are at a relatively high level. Among the factors which affect crop yields, increased applications of commercial fertilizer are most effective in increasing yields.

An analysis of the effect of varying proportions of sod crops on inputs and outputs indicate that for medium-size dairy farms with a high proportion of sod crops milk production per cow is higher, fertilizer costs are lower and purchased feed costs are higher than for the low-sod farms.

It is concluded that, in 1953, for dairy farms averaging about 100 crop acres, the high-sod and low-sod groups paid equally well, but the most profitable crop rotation included about one-third of the cropland in sod crops and two-thirds in small grains and row crops for feed or sale.

143 pages. \$1.79. Mic 56-306

A STUDY OF POSSIBLE REASONS FOR THE DIFFERENTIAL ACCEPTANCE OF SOIL CONSERVATION PRACTICES IN SELECTED AREAS OF HONEOYE-LIMA SOIL ASSOCIATION

(Publication No. 15,608)

Julian Prundeanu, Ph.D.
Cornell University, 1955

Statement of the Problem

This study attempts to answer some of the questions related to the acceptance or non-acceptance of soil conservation practices by the farmers in the Honeoye-Lima soil association. As there were about twenty different soil conservation practices recommended by the Soil Conservation Service technicians, it was of particular interest to find out which were accepted, which were rejected and why.

Methods

Two approaches were used. The one was to relate the amount of soil conservation established to the physical characteristics of the land and to some of the economic factors involved in the process of agricultural production. For this, the correlation coefficient (r) and Pearson's mean square contingency were computed. The other was mainly a survey approach consisting of a detailed interview with thirty farmers chosen at random, fifteen belonging to the high conservation group and fifteen to the low conservation group. A student t Test of significance was also made.

Results and Conclusions

1. Little or no relationship had been found between single physical and economic factors and the amount of soil conservation established when the correlation coefficient and Pearson's mean square contingency were used.

2. The practices established to a larger extent can be grouped roughly in two categories:

- practices related to water control
- practices related to pasture and permanent hay

These practices were not necessarily the least expensive to install. They required, however, comparatively little maintenance and represented less inconvenience for the farming operations than practices established to a lesser

extent. Moreover, they belonged to the practices which the farmer agreed to readily. They represented also practices for which substantial federal or in some cases state aid was made available in order to promote their use.

3. The practice which enjoyed the widest acceptance was tile drainage. The least accepted were contour farming and cropland terraces.

4. Once the farmers have agreed to establish a practice, they generally do so. It would appear that trying to have the farmer agree to establish a practice is an important point in having it established.

5. The farmers belonging to the high conservation group in the Cayuga Subsample compared with the ones of the low conservation group as follows:

- a. they operate smaller farms, however, much larger than the average farm in the area -
- b. they have less amount of land in pasture and woods
- c. they have fewer cows but more hens -
- d. they have a smaller amount of total productive man work units -
- e. the value of land and buildings per 100 acres of total land operated was about 75 percent higher -
- f. they operate better land in terms of land use capability classes -
- g. more farmers operate on father and son partnership basis -
- h. a larger number thought of soil conservation as being "very" important.

6. As part of their over-all farm management plan, new buildings and improving old ones ranked first, followed by increasing or improving livestock and buying equipment. Only after that, did the farmers turn their attention and efforts to improve their land.

7. Acceptance or non-acceptance of soil conservation practices by the farmers is a complex process in which the physical characteristics of the land are not necessarily the most important part. According to the findings of this study most important is the conviction on the part of the farmer that:

- a. the respective practices are needed -
- b. they are feasible -
- c. they work -
- d. they do not drastically interfere with the customary manner which the farmer has used to work his land -
- e. they are easy to maintain -
- f. they do not interfere with the efficient use of modern equipment -
- g. they represent, in the mind of the farmer, proven sound management practices.

223 pages. \$2.79. Mic 56-307

HOST-PARASITE INTERACTION OF EIGHT VARIETIES OF OATS INFECTED WITH RACE 202 OF CROWN RUST

(Publication No. 15,259)

Paul George Rothman, Ph.D.
University of Illinois, 1955

A study of crown rust infection on eight varieties of oats differing in their reaction to race 202 was undertaken to

ascertain the developmental pattern of the fungus, together with the accompanying histological changes occurring within the infected leaf tissue. Four of the eight varieties exhibited a high degree of resistance with varying patterns of chlorosis and necrosis. The other four were classified as susceptible.

All plant material was grown under greenhouse conditions. Inoculated seedling leaves were killed and fixed at intervals of 12 and 24 hours up to 240 hours after inoculation. The paraffin method was followed in preparing the sections for study.

The anatomy of the seedling leaf, with some minor differences, was found to be similar to that of the mature oat leaf.

The normal developmental pattern of crown rust infection includes germination of the urediospore, growth of the germ tube, formation of an appressorium over a stoma, penetration of the stomatal slit by the appressorial peg, development of a substomatal vesicle with infection hyphae, the growth of the mycelium within the intercellular spaces of the leaf mesophyll with the formation of haustoria, the formation of the uredium, and sporulation.

Microscopic observations of perceptible changes observed on the inoculated leaves of the eight oat varieties such as flecking, chlorosis, necrosis, raised epidermis, ruptured epidermis, and pustule formation made possible the classification of the varieties into four groups; namely: Group I, Highly Susceptible; Group II, Moderately Susceptible; Group III, Resistant; Group IV, Highly Resistant.

Microscopic observations showed that certain phases in the life cycle of the rust parasite were common to all of the varieties regardless of their reaction to the fungus. These were the period of initiation of germination of the urediospores, the development of the germ tube, formation of the appressorium, penetration of the stomatal slit by the appressorial peg, the swelling of the peg within the substomatal cavity, and the development of the vesicle and infection hyphae.

Differences which characterize the four groups are as follows: the physical appearance of the substomatal vesicle and growth of the infection hyphae, the number of nuclei present in the infection hyphae, the staining characteristic of the mycelium, haustoria formation, the extent of penetration of the hyphae within the leaf, cellular disturbances of the host cells, and the reproductive capacity of the parasite.

The normal pattern of rust development occurred in Group I.

Not all substomatal vesicles in Group II sent out infection hyphae while the rate of growth of the parasite lagged 24 hours behind the development pattern of Group I. Also, uredia were surrounded by a definite chlorotic area.

The protoplasmic contents of the substomatal vesicles in Groups III and IV appeared to consist of granules rather than of a definite reticulum. Only the actively growing tips of the mycelium remained filled with dense protoplasm.

Antagonistic reactions between host and parasite occurred 72 hours after inoculation within Group III. Limited vegetative growth of the fungus followed with isolated attempts to form sori. Rapid necrosis of the entire inoculated leaf arrested the further spread of the parasite.

Rapid cellular disorganization of the host plants followed 48 hours after inoculation of Group IV. Hyphae penetration and haustoria formation was checked by the breakdown of host tissue. Only the tissue invaded by mycelium was destroyed, while non-infected portions of the inoculated leaves were unaffected.

81 pages. \$1.01. Mic 56-308

INSURANCE PROGRAMS ON NEW YORK FARMS

(Publication No. 15,506)

John Robert Tabb, Ph.D.
Cornell University, 1955

This study deals with the insurance practices followed by a group of farmers in New York State. The objectives of the study were to (1) determine the current insurance practices and programs being followed by commercial farmers in New York and (2) evaluate these practices.

The data on which this study is based were collected in 1953 from a random sample of a group of commercial farmers in New York. Interviews were obtained from 587 farmers during which the enumerators recorded a description of all of the insurance the farmers carried.

It was decided that some form of criteria must be established before the farmers' insurance programs could be evaluated. The first part of the study deals with an inquiry into the role of insurance, the need for a logical thought process in approaching decisions regarding insurance and a pattern of "reasonable" conclusions is reached concerning the planning of each specific type of insurance coverage.

The next section of the study presents a census of the practices followed by the farmers interviewed. About three-fourths of these farmers had life insurance coverage on the farm operator. However, the average coverage of \$6,219 was probably not enough and certainly many farmers, with little or no life insurance, were not adequately providing for their dependents.

Almost all of the farmers had some fire insurance coverage. Items of movable property, such as machinery, livestock, etc., were not insured as frequently as were buildings. Buildings were normally insured for a greater percentage of their value than were these other items. The average amount of total fire insurance carried was \$25,400. This represented about three-fourths of the current market value of the property insured.

Insurance carried on motor vehicles most frequently provided for Personal Injury Liability coverage of \$10,000-20,000, Property Damage Liability coverage of \$5,000 and no Medical Payments, Comprehensive or Collision insurance coverage. Those farmers who had selected Medical Payments coverage most frequently chose coverage in the amount of \$500; those with Collision coverage chose a \$50 deductible plan most frequently.

Less than half of the farmers had taken out Public Liability insurance. About one-fourth carried either Farm Employer's Liability or Workmen's Compensation insurance.

Most of the farmers had some Health and Accident insurance, but the typical coverage was very limited.

Crop insurance was found only on 26 farms. Most of this insurance was Federal Crop Insurance purchased to cover losses of grain crops.

The ability to pay for insurance (as indicated by measures of financial strength) was the factor found to be most consistently associated with higher amounts of coverage.

It was concluded that most of the farmers' insurance programs were not adequate. This was most likely the result of (1) lack of understanding of the proper use of insurance and the technical aspects of insurance contracts and/or (2) unwillingness or lack of ability to pay for greater protection. In general, it would appear that those farmers who most need insurance are frequently the least able to pay for it.

234 pages. \$2.93. Mic 56-309

ADSORPTION OF DDT, METHOXYCHLOR, AND SOME RELATED COMPOUNDS ON THE SURFACES OF INSECTICIDE DUST DILUENTS AND CARRIERS

(Publication No. 15,510)

Donald Edward Weidhaas, Ph.D.
Cornell University, 1955

Experiments have been conducted to study the adsorption of several chlorinated organic insecticides and related compounds on the surfaces of typical insecticide-dust diluents and carriers. The adsorption was measured from organic solvents. These experiments were conducted in conjunction with a research project on the physical and chemical properties of diluents and carriers as the initiation of the study of the interaction of insecticides with diluents and carriers.

Of the many methods available to study the adsorption of a material from solution by a solid surface the one used in these experiments is perhaps the simplest. Solutions of known concentrations of the insecticides and related compounds in a total of fifty milliliters of organic solvents were prepared. A weighed amount of the diluents or carriers was added to these solutions and the resulting suspensions were shaken and allowed to come to equilibrium. The amount of insecticide or related compound adsorbed was calculated from the difference between the initial and the final concentration.

Five typical diluents and carriers representing five major mineral groups were chosen as adsorbents: Panther Creek Bentonite, a montmorillonoid; Diluex A, an attapulgite; Barden Clay, a kaolinite; Celite 209, a diatomite; and Pyrax ABB, a pyrophyllite. These particular five diluents and carriers were selected because they are commercially available products and because they represent five important mineral types of diluents and carriers with large differences in properties and structure. Two chlorinated insecticides; DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane) and methoxychlor (1,1,1-trichloro-2,2-bis(p-methoxyphenyl) ethane), and three related compounds; DDE (1,1-dichloro-2,2-bis(p-chlorophenyl) ethylene), methoxy DDE (1,1-dichloro-2,2-bis(p-methoxyphenyl) ethylene), and DDA (2,2-di(p-chlorophenyl) acetic acid) were chosen as adsorbates. These particular five adsorbates were selected since they had the same structural skeleton with differing functional groups. Three organic liquids; hexane, 95% ethanol, and benzene, were used as solvents. Limited preliminary studies were conducted to determine the relative amount of adsorption, differences in adsorption, and conditions favorable for adsorption. Then further experiments were conducted to study the effect of the different types of diluents and carriers and the effect of the different insecticides and related compounds on the amount of adsorption. During the course of the experiments reaction and catalytic change of both methoxychlor and methoxy-DDE were observed when these two materials were adsorbed on three of the five diluents and carriers studied.

Adsorption of DDT, DDE, methoxychlor, methoxy-DDE and DDA was measured on typical diluents and carriers under the conditions of these experiments. The amount of adsorption varied with the type of diluent or carrier, the organic adsorbate, the solvent used and the pretreatment of the diluent or carrier. The difference in the amount of adsorption caused by the different diluents and carriers was explained on the basis of the nature and the extent of the surface areas of these materials. Variations in the

amount of the various insecticides and related compounds adsorbed by a given diluent or carrier were explained on the basis of the structure of the organic adsorbate.

During the experiments on adsorption reaction of methoxy-DDE and methoxychlor was observed on the surfaces of diluents and carriers. This reaction was of two types: (1) color development on the surface, and (2) catalytic change. Reaction occurred on only three of the five diluents and carriers. These were Panther Creek Bentonite, Diluex A and Barden Clay. Comparisons of the amount of reaction on different diluents and carriers indicated that this reaction is correlated with the presence of acid sites on the surface of the materials.

69 pages. \$1.00. Mic 56-310

THE PERSISTENCE OF HEPTACHLOR IN SOILS

(Publication No. 15,538)

William Robert Young, Ph.D.
Cornell University, 1955

This study was undertaken to determine the persistence of heptachlor, an effective chlorinated hydrocarbon insecticide developed by the Velsicol Corporation, Chicago, Ill. in soils of several types. Experiments were conducted to determine how long this compound would persist when incorporated in the soil and when sprayed on the soil surface. The possible vertical movement of heptachlor through the soil by action of water was also studied.

The soil samples were extracted with an organic solvent. The residues present in the extracts were then determined with a colorimetric method of analysis specific for heptachlor. An extraction procedure was developed that involved shaking the soil samples in quart mason jars with a solvent mixture of pentane, isopropanol, and glacial acetic acid in the ratio of 4:1:1 by volume. When this solvent was used, the recoveries of heptachlor were close to the theoretical amounts of heptachlor that had been applied to the soil.

Since the chemical method of analysis that was employed was specific for heptachlor, toxic metabolites or degradation products might not be detected. Consequently, part of the soil samples of each soil type were also analyzed with a bioassay in an attempt to detect other toxic compounds that might have been missed by the chemical method. A bioassay technique, in which adult fruit flies, *Drosophila melanogaster*, were exposed to the surface of soil-apple-sauce mixtures, was developed. A comparison of the mortalities obtained from field samples and prepared standards, provided an index of the residues present.

The persistence of heptachlor in four soil types, Dunkirk sandy loam, Dunkirk silt loam, Dunkirk silty clay loam and muck, was determined in this investigation.

In an experiment where heptachlor was incorporated in the soil of field plots at 2 and 4 pounds per acre, an average of 26 percent of the amount present after treatment persisted for at least 21 months. When heptachlor was thoroughly mixed into soils of the same types at the rates of 2 and 4 pounds per 6 inch acre, and these treated soils were exposed to the weather in metal cylinders placed in the ground, an average of 53 percent of the amount applied persisted for at least 21 months over all soil types.

In experiments involving six weekly spray applications to the soil surface only 30 percent of the total amount (4.2 pounds per acre) applied was present one week after the last application in the muck soil. Under similar conditions 11 percent persisted in silty clay loam and 8 percent persisted in a silt loam. In these experiments losses of heptachlor from the soil were less from an emulsion formulation than from a wettable powder. Losses from all soil types were greater from soil surfaces exposed to the sun than from shaded soil surfaces. Superficial cultivation of the soil surface during the spray period apparently did not affect the persistence of this insecticide.

The losses of heptachlor from the soil are attributed to the evaporation of this compound from the soil surface. No evidence that heptachlor is leached from the soil, or is broken down into toxic degradation products or metabolites, was found in this investigation.

It is concluded from the results obtained that heptachlor will not accumulate to harmful levels in our cultivated soils in connection with its use as a soil treatment or as a foliage spray in the amounts that are required for efficient insect control.

106 pages. \$1.33. Mic 56-311

AGRICULTURE, ANIMAL CULTURE

EFFECTS OF CERTAIN FACTORS ON THE AMINO ACID REQUIREMENTS OF THE CHICK

(Publication No. 15,213)

Paul Griminger, Ph.D.
University of Illinois, 1955

Knowledge of the exact requirements of domestic animals for certain nutrients is a prerequisite for the formulation of economical rations. In this study three of the factors that might cause variations in the amino acid requirements of growing chicks were investigated, namely the relation of the requirements to protein level, bulkiness of the diet, and rate of growth of chicks.

Employing diets based on Drackett Protein and cerelose and amply fortified with cystine, choline, and vitamin B₁₂, the methionine requirement of growing crossbred male chicks was studied at four different levels of protein. With diets containing 10 and 20 percent protein, optimum growth was obtained when the methionine level was at least 1.6 percent of the protein. When 30 or 40 percent protein was supplied, the methionine requirement did not appear to be much in excess of one percent of the protein. Due to the methionine content of the basal diet, a minimum requirement for these levels could not be definitely ascertained. It thus appears that the requirement for methionine at super-normal protein levels is not a constant percentage of the protein.

Diets based on acid-hydrolyzed casein and dextrin, containing 10, 20, 30, and 40 percent protein, were employed to investigate the tryptophan requirement of growing crossbred male chicks at different protein levels. Calculating from the experimental data with the help of a least-squares method, 0.09, 0.143, 0.182, and 0.20 percent L-tryptophan

of the diet were obtained as the minimum requirements at the four protein levels. This constitutes an increase at a decreasing rate of the absolute tryptophan requirement with higher protein levels.

When populations of chicks were fed adequate diets for one or two weeks and then classified according to their weight, no statistically significant differences in the requirements for certain amino acid, expressed as percent of the diet, could be found for optimum growth between the fast- and slow-growing groups of each population. The amino acids investigated were methionine, tryptophan, and lysine. These studies also suggested that chicks from one population, kept for two weeks under identical environmental and dietary conditions, and then selected for fast and slow growth differ in physiological age at given times during the following two weeks.

While different rates of growth of chicks of the same type seemingly do not influence amino acid requirements if the latter are expressed as percent of the diet, the caloric density of a diet and, as has been shown in the case of tryptophan, the level of protein can decisively influence these requirements, expressed in this way. When the caloric density of purified and semi-purified diets was lowered through the replacement of part of the carbohydrate with non-nutritive fiber, feed consumption was increased. When these diets were partly deficient in an amino acid, this increased feed consumption enhanced in some cases the growth promoting properties of the diet, probably through an increased absolute intake of the limiting amino acid.

95 pages. \$1.19. Mic 56-312

UTILIZATION OF D-TRYPTOPHAN BY THE CHICK

(Publication No. 15,247)

William Douglas Morrison, Ph.D.
University of Illinois, 1955

The utilization of D-Tryptophan by the young chick was studied using weight gain and nitrogen balance as the criteria. Male chicks originating from a New Hampshire male x Columbian female cross were used. In all cases only the individual D isomer was used in establishing the utilization of D-tryptophan.

The diet used contained acid-hydrolyzed casein and gelatin as the major protein sources and corn as the carbohydrate source. This diet contained approximately 0.036 percent tryptophan.

The initial experiment consisted of three lots receiving D-tryptophan at 0.20, 0.40 and 0.60 percent of the diet. Results indicated slight utilization of D-tryptophan for growth. Subsequent experiments in which D-tryptophan was added in amounts ranging from 0.0 to 2.7 percent of the diet indicated a requirement for orally administered D-tryptophan of approximately 2.1 percent of the diet. This is approximately 14 times the supplemental L-tryptophan requirement on this diet.

Determination of the pyridine nucleotide content of the livers of chicks fed various amounts of D-tryptophan indicated that the D isomer was not being converted to nicotinic acid. In addition, using growth as the criterion, the use of a diet, low in niacin and containing slightly less than the optimum amount of L-tryptophan, showed that D-tryptophan

was not functioning as a direct precursor of nicotinic acid in the young chick.

In order to determine if the chick's tissues could metabolize D-tryptophan without the assistance of the intestinal microflora, subcutaneous administration of this isomer was undertaken. Preliminary work indicated that injection of the L isomer every three hours (with the exception of the 3:00 a.m. injection) was satisfactory. These injections were made subcutaneously in the neck region and physiological saline was used as the carrier. The basal diet and water were supplied *ad libitum*.

Using this procedure the approximate requirements for parentally administered L- or D-tryptophan in mg. per day are 91 and 236 respectively. The requirement for D-tryptophan when administered in this way is approximately 2.5 times the requirement for injected L-tryptophan. Nitrogen-balance work indicated that the D isomer, when administered subcutaneously, caused a striking increase in nitrogen retention.

This work indicates that the chick is able to utilize D-tryptophan for growth without assistance from the intestinal microflora. It further suggests that inefficient absorption is the major impediment to efficient utilization of orally administered D-tryptophan by the young chick.

84 pages. \$1.05. Mic 56-313

THE EFFECT OF SUPPLEMENTARY FAT IN THE RATIONS OF LACTATING SWINE

(Publication No. 15,523)

Roland Norman, Ph.D.
Cornell University, 1955

The influence of dietary fat on lactation performance of several species of animals has been studied in great detail. Only recently, however, have nutritionists added waste animal fat to lactating rations for swine.

In this thesis, a study of the lactation performance of swine fed rations supplemented with different levels of animal fat is reported.

Three experiments were conducted during successive farrowing seasons (1954-55) including 39 purebred Berkshire, Yorkshire, and Chester White sows and litters to determine the effect of dietary supplemental fat on lactation performance.

The sows received a 16%-protein basal ration containing ground yellow corn, alfalfa meal, soybean oil meal, wheat middlings and iodized salt, and rations containing 7% fat and 20% fat fed continuously. Change-over rations included 7% fat during the first four weeks and 20% fat during the last four weeks, and also 20% fat during the first four weeks and 7% fat during the last four weeks of lactation.

Weight gains of the litters, gain or loss of weight of the sows, milk-fat content and over-all feed efficiency were used as criteria of evaluation of the different treatments.

The sows were milked at regular intervals and the litters were weighed at these times.

One hundred sixty-eight milk samples were collected during early, middle and late lactation. The fat content of the milk tended to be highest during the middle of lactation and decreased with the advance of lactation. The mean milk-fat content of the Basal, 7% and 20% fat-fed sows

(including periods in the change-over design) were 6.73, 7.18 and 7.92 per cent, respectively.

Digestion coefficients for dry matter and fat were determined by the chromium oxide technique. Considerable variation in digestibility was noted within and between rations fed to sows at different periods. With the exception of the Spring trial 1954, digestion coefficients for dry matter were higher in the fat-substituted rations. Apparent digestibility of fat was higher in the supplemental rations in all periods. The digestion coefficients (3 trials) for dry matter and fat, respectively, were: Basal, 78, 74; 7% fat, 77, 85; 20% fat, 84, 91 (change-over periods included).

The fat content of baby-pig feces was determined by ether extraction, the method of the Association of Official Agricultural Chemists. Fat excretion tended to decrease as lactation advanced. Mean fecal fat percentages calculated at 21, 35, and 56 days of lactation, respectively, were: Basal - 15.3, 10.7, and 11.0; 7% fat - 11.2, 7.8, and 4.1; 20% fat - 28.6, 16.2, and 10.3; 20-7% fat - 16.6, 16.8, and 10.9; and 7-20% fat - 12.9, 21.9, and 9.4.

Weight gains and feed efficiency were subjected to statistical analysis. Analysis of variance showed no significant difference in feed efficiency, i.e. pounds of feed per pound of gain, between treatments in the Spring or Fall trials, 1954. However, in Spring 1955, weight gains ($.01 < P < .05$) and feed efficiency ($P < .01$) were greater for the continuous fat rations. Weight and feed were not significantly different between treatments in the change-over design. The rate of gain within treatments was significantly greater during the latter periods ($P < .01$).

An increase in feed efficiency was evident but no appreciable influence was exerted on the mean weaning weights of the pigs for the three trials as a result of adding supplementary fat to lactating rations. This suggests the importance of such factors as birth weights, litter size and inherent ability to grow in determining the growth rate of suckling pigs.

58 pages. \$1.00. Mic 56-314

RELATIVE VALUE OF CORN, OATS, AND HOMINY WHEN FED WITH MOLASSES TO FATTENING YEARLING STEERS ON PASTURE

(Publication No. 15,606)

Ellis Andine Pierce, Ph.D.
Cornell University, 1955

Chairman: John I. Miller

This study was designed to determine the relative nutritive value of combinations of one-half ground corn, ground oats, or hominy and one-half molasses when fed to fattening yearling steers on pasture. Also determined were the financial returns and the effect of the above rations on the yield and grade of the carcasses produced.

Three lots of thirteen yearling Hereford steers were fed the above rations on improved permanent pasture for a period of 153 days during each of two trials. The criteria used in determining the relative values were: (1) total gain, (2) feed required to produce 100 lbs. of gain, (3) calculated total digestible nutrients (T.D.N.) required per pound of gain, (4) net return per steer above steer and feed costs, and (5) the relative value per ton of the feeds fed based on net returns.

The relative value per ton of the various feed

combinations was calculated as follows: Relative value of concentrates = actual price of concentrates per ton + $\left(\frac{\text{Diff. in net return/steer from standard ration}}{\text{lbs. of concentrate consumed/steer}} \times 2000 \right)$.

The results of two trials show that feeding a combination of corn and molasses to fattening yearling steers on pasture resulted in higher average daily gains; in lower feed costs per hundredweight of gain; in slightly higher slaughter grades; and in a higher average net return per head above steer and feed costs than combinations of ground oats and molasses or hominy and molasses when fed to similar steers on pasture.

The steers fed ground corn and molasses gained 2.04 lbs. per day as compared to gains of 1.90 lbs. and 1.97 lbs. per day, respectively, for the steers fed oats and molasses and hominy and molasses. Also, less calculated T.D.N. was required to produce a pound of gain by these steers than by similar steers fed the other feed combinations and the net return per head above steer and feed costs was greater.

Under the conditions of this experiment and based on net return per steer, the combinations of ground oats and molasses and hominy and molasses were worth 65.6 per cent and 82.5 per cent, respectively, the value of the corn and molasses combinations as fed in these trials. When based on the amount of calculated T.D.N. required to produce a pound of gain, values of 89.1 per cent and 95.4 per cent that of the corn and molasses combination were obtained for the combinations of oats and molasses and hominy and molasses, respectively.

Although the average dressing percentages for the steers fed corn, oats, and hominy with molasses were essentially the same, 58.2, 58.2, and 58.0 per cent, respectively, the carcasses produced by the steers fed corn and molasses graded slightly higher.

78 pages. \$1.00. Mic 56-315

UNIDENTIFIED FACTORS IN CHICK, POULT, AND HEN NUTRITION

(Publication No. 15,308)

George Bentley Sweet, Ph.D.
University of Maryland, 1955

Supervisor: Dr. G. F. Combs

In experiments conducted with chicks, poults and hens, unidentified nutrients were found to be required for growth and hatchability. The growth responses obtained with chicks when the basal ration was supplemented with unidentified growth factor supplements were not altered by deutectomy, sex, or strain difference. However, the use of copper rather than galvanized waterers did increase the growth response of chicks to these supplements.

Orally administered penicillin spared the requirement of chicks for unidentified growth factor supplements when added to both sucrose-soybean oil meal and sucrose-Drackett type diets, but the response was greater in the soybean oil meal diet. The antioxidant, DPPD, also spared the requirement in the sucrose-soybean oil meal diet but had no apparent effect in the sucrose-Drackett diet.

The findings indicate that there are three distinct unidentified growth factors; one found in liver fraction 2,

another in dried whey product and a third in dehydrated alfalfa meal. Dried molasses distillers solubles, fish solubles, dried brewers yeast, corn fermentation product, a primary fermentation product (Pfizers), and forage juice concentrate also were found to have unidentified growth factor activity for chicks. Dehydrated alfalfa meal, dried brewers' yeast, dried whey product and liver fraction 2 also had a stimulatory effect on the growth of poults.

The unidentified factor activity of condensed fish solubles was also shown to be required for hatchability of fertile hens' eggs. Orally administered iodinated casein increased the requirement for this factor. Penicillin and chlortetracycline did not measurably effect the hatchability of fertile eggs.

Carbon tetrachloride administration did not apparently increase the requirement of chicks for these unidentified growth factors. There was also no observed relationship between unidentified growth factor supplementation and antibody production of chicks and hens. However, chicks receiving unidentified growth factor supplement had higher blood serum protein levels.

126 pages. \$1.58. Mic 56-316

AGRICULTURE, PLANT CULTURE

ION ABSORPTION BY CORN ROOTS AS INFLUENCED BY MOISTURE AND AERATION CONDITIONS

(Publication No. 15,196)

Robert Eldon Danielson, Ph.D.
University of Illinois, 1955

Young corn seedlings, selected for uniformity of size, were grown for 24 hours in soil of known moisture tension and in an inert, porous medium wetted with an aqueous solution of mannitol of known osmotic pressure. In each case moisture stress values of 1/3, 1/2, 1, 3, 6, and 12 atmospheres were represented, and the radioactive isotope Rb⁸⁶ was present as a tracer ion. Oxygen treatments were imposed by passing a gas mixture of air and commercial grade nitrogen through the culture chambers at a constant rate. At each value of moisture stress five concentrations of oxygen, 0.26, 2.10, 5.25, 10.5, and 20.6 percent by volume, were studied.

At the termination of each experiment the seedlings were removed from the culture chambers, cleaned, and the embryonic axes excised from the remainder of the seedling. This embryonic tissue was weighed, oven-dried, weighed again, and digested to a white ash with acid. The soluble ash was dissolved in water and measured for radioactivity with appropriate equipment. The data involving fresh weight, tissue hydration, and specific activity per unit weight of oven-dry tissue were statistically analysed.

Rubidium accumulation in the embryonic tissue was directly related to the oxygen concentration of the aerating gas in both the soil and mannitol experiments. The influence of oxygen on the seedlings grown in soil varied for the different levels of soil moisture tension. Osmotic pressure, however, did not statistically alter the shape or

location of the ion uptake-oxygen curves. In no case was there a significant influence of oxygen concentration on ion uptake at oxygen contents above 10.5 percent by volume. Corn seedlings growing in soil showed a much greater response to initial increases in oxygen concentration, especially at low values of soil moisture tension, than did the seedlings growing in the mannitol cultures.

A sharp contrast was shown between the effects of soil moisture tension and osmotic pressure on rubidium absorption. In the soil experiments a sharp decrease in Rb⁸⁶ uptake was shown as the moisture tension increased. This decrease was almost as great for moisture tensions between 1/3 and 1 atmosphere as it was between 1 and 12 atmospheres. A nearly linear relationship existed, however, between the Rb⁸⁶ content of the embryonic tissue and percent moisture in the soil. The influence of osmotic pressure on rubidium uptake was not statistically significant.

The following conclusions were drawn from the data collected in the study:

1. The accumulation of rubidium ions by young corn seedlings is influenced to a marked degree by oxygen concentrations below a certain critical level.
2. The critical oxygen level is directly related to the moisture content of the culture medium and is independent of the osmotic pressure.
3. The magnitude of the effect of oxygen on rubidium uptake decreases with increasing soil moisture tension.
4. Rubidium uptake is not influenced to any appreciable extent by the osmotic pressure of the solution in which the plants are grown.
5. Large decreases in the degree of root and shoot hydration at high moisture stress apparently is not a limiting factor to rubidium accumulation by young corn seedlings.

66 pages. \$1.00. Mic 56-317

A STUDY OF THE SEEDLINGS FROM CONTROLLED CROSS-POLLINATIONS OF CERTAIN TETRAPLOID APPLE VARIETIES

(Publication No. 15,198)

Daniel Francis Dayton, Ph.D.
University of Illinois, 1955

Tetraploid forms of cultivated apple varieties have only recently been discovered, and little is known concerning their reproductive behavior. From the standpoint of utilization, the proportions of functioning gametes, viability of seed, and relation to chromosome number to seedling vigor are important considerations. In this investigation, selected diploid seedlings were used as pollen parents in controlled crosses with the tetraploid forms of McIntosh, Golden Delicious, and Jonathan. Controlled crosses of tetraploid x tetraploid were also made. Seedling root-tips were collected and prepared for cytological examination by the paraffin method.

Germination of triploid seed was relatively low, totalling 60.2 per cent from McIntosh and 64.4 per cent from Golden Delicious. The difference was not statistically significant. Seed viability from tetraploid x tetraploid crosses was considerably higher, ranging from 84 to 91 per cent.

Aneuploids of 51[±] chromosome number comprised 8.3 per cent of the 240 seedlings from tetraploid Golden

Delicious x diploid. In the 259 seedlings from tetraploid McIntosh x diploid 7.1 per cent were aneuploid. The number of seedlings with 49-51 chromosomes was about equal to the number with 51-53 in both tetraploid McIntosh and tetraploid Golden Delicious. No aneuploids were found in the 19 seedlings from tetraploid Jonathan. These progenies also included 23 diploid seedlings, 9 tetraploids and 1 pentaploid. A major portion of the aneuploids was apparently eliminated by the low viability of seed. In tetraploid x tetraploid progenies 21.6 per cent were aneuploid. Chromosome numbers ranged from 68 to 77. Seedlings of 68+ chromosome number constituted 75 per cent of the aneuploids.

Proportions of non-vigorous seedlings were nearly equal among the tetraploid seed parents but highly variable among progenies. The difference between McIntosh and Golden Delicious was not statistically significant. None of the seed parents produced more than 20 per cent of non-vigorous seedlings.

At second metaphase of microsporogenesis in tetraploid Golden Delicious only about 40 per cent were found to have balanced chromosome number. Chromosome numbers in individual metaphase figures ranged from 27 to 40. The flowers were forced in the laboratory and probably are not typical of orchard behavior of this variety.

Although 88 per cent of field-collected pollen of tetraploid Golden Delicious stained deeply, only 40.2 per cent germinated with sufficient vigor to be capable of effecting fertilization. 70 pages. \$1.00. Mic 56-318

EFFECT OF SOIL MOISTURE STRESS AND OXYGEN CONCENTRATION ON THE GROWTH OF CORN ROOTS

(Publication No. 15,209)

Joe Ray Gingrich, Ph.D.
University of Illinois, 1955

Small corn seedlings, selected for uniformity of radicle length, were grown for 24 hours in soil and in osmotic pressure media of 1/3, 1/2, 1, 3, 6, 9, and 12 atmospheres moisture stress in combination with oxygen concentrations of 0.26, 2.10, 5.25, 10.5, and 21.0 percent by volume. Growth properties studied were radicle elongation and fresh weight, dry weight, and degree of hydration of the embryonic axes.

When oxygen was not limiting, all measured growth properties decreased with increasing soil moisture tension and osmotic pressure media. In this case dry weight was not affected by osmotic stress.

The greatest difference in the growth responses between the two types of stress, when oxygen was not limiting, occurred in the 1 to 3 atmosphere stress range. In this range growth was much more sensitive to soil moisture tension than it was to osmotic stress.

From the experimental data collected the following conclusions are drawn:

1. In the absence of other limiting factors, elongation of the corn radicle and embryo fresh weight decrease with increasing soil moisture tension or osmotic stress over the 1 to 12 atmosphere range.

2. The increase in dry weight of corn embryos becomes

progressively less as the soil moisture tension increases from 1/3 through 12 atmospheres when growth occurs in the presence of adequate oxygen but is unaffected by osmotic stress regardless of the oxygen concentration.

3. The degree of hydration of corn embryos decreases with increasing soil moisture tension or osmotic stress and is affected slightly by the concentration of oxygen.

4. The limiting concentration of oxygen for root growth responses to moisture stresses depends on the particular growth property measured.

5. Root growth is unaffected by moisture stress in the range from 1/3 through 1 atmospheres.

6. Root growth is usually greater when growth occurs in osmotic stress media than when it occurs in soil at moisture tensions of equivalent stress.

7. If oxygen is not limiting, root growth is much more sensitive to changes in soil moisture tension in the 1 to 3 atmosphere range than it is for any other tension range.

8. Growth characteristics that are influenced by osmotic stress respond linearly throughout the 1 to 12 atmosphere stress range.

9. The water transmission characteristics of soil appear to significantly affect root growth, particularly in the 1 to 3 atmosphere tension range.

10. The effect of oxygen concentration on corn root growth depends greatly on the moisture stress of the medium in which growth occurs. 78 pages. \$1.00. Mic 56-319

MINERALS OF THREE KANSAS SOILS DEVELOPED FROM LOESS

(Publication No. 14,713)

Abraham Kaufman, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Marion L. Jackson

Three soils developed in Kansas from Peorian loess under varying rainfall were investigated. The soil samples represented the indicated horizons from each of the following great soil groups: (1) Sierozem-like soil, horizons A₁, B, and C₃, (2) Chestnut soil, horizons A₁₂, B₂₂, and C₂, and (3) a Grey-Brown Podzolic soil, horizons A₁, B₂₂ and C₂. The fractions analyzed in detail were the fine silt, coarse clay, medium clay, and fine clay. An attempt was made to ascertain mineral differences due to particle size, function of depth and geographic distribution. The following analytical methods were employed: particle size segregation, x-ray diffraction, differential thermal analysis, water loss data (110°-900°C), cation exchange capacity measurement, specific surface measurement, electron micrographs, and elemental analysis. The results of this investigation may be summarized as follows:

- (1) The sand and silt consisted of about 70 per cent quartz, about 20 per cent feldspars, about 5 per cent illite and about 5 per cent other 2:1 layer silicates interstratified in the illite. The fine silt contained 1.5 per cent K₂O.

- (2) The clay fractions showed a predominance (about 80 per cent) of dioctahedral layer silicates involving in major part expandable kinds and containing a little illite. The coarse clay contained about 1 per cent K₂O and the fine clay, about 0.6% K₂O. From 5 to 7 per cent combined Fe₂O₃ and

mainly less than 1.5 MgO occurred in the medium and fine clay fractions. Kaolin, including some halloysite, occurred in the coarse clay and medium clay fractions.

(3) Quartz and feldspars decreased with particle size in all horizons, being appreciable in the fine silt and coarse clay but inappreciable in the medium and fine clay fractions.

(4) Only minor mineralogical trends were observed as a function of depth. There was a slight increase of montmorin with depth in the Chestnut soil.

(5) The mineralogical analyses of the soils did not appear to reflect the difference in mean annual rainfall.

(6) The predominant constituents of the fine and medium clay are believed to have been derived by weathering of illite to an interstratified mixture ("mixed layer" system) involving some considerable amounts of montmorin.

130 pages. \$1.63. Mic 56-320

COLD TOLERANCE STUDIES WITH HYBRID SEED CORN

(Publication No. 15,479)

Gerard Neptune, Ph.D.
Michigan State University, 1954

Commercial seeds for two susceptible and three tolerant double-cross corn hybrids were cold tested in wet soil at 32° F and 40° F. All samples were treated with a seed disinfectant and were capable of highly satisfactory germination under standard laboratory conditions. After pre-cold treatments of 0, 1, 2, 3, or 5 days of warm temperature, seeds of each of the five hybrids were given cold treatments of 4, 8, 12, or 16 days at 32° F or 40° F.

At both temperatures, exposing the seed to cold immediately or one day after planting resulted in nearly the same decreases in stand. Germination decreased as the pre-cold treatments increased beyond one day. Apparently in the more advanced stages of germination the seed became more susceptible to attack by the soil pathogens responsible for cold germination injury. Three days of favorable conditions prior to cold treatment reduced the stand of all hybrids by 50 percent or more.

In general, increase in duration of exposure to cold resulted in lower germination. Pre-cold treatments of 0 and one day followed by cold treatments at 32° F were less injurious than similar pre-cold treatments followed by 40° F cold treatments. It is likely that the soil pathogens were more active at 40° F than at 32° F. In the more advanced stages of germination, cold treatments at 32° F were more injurious than similar treatments at 40° F and apparently the seed was more injured by cold itself at 32° F than by soil pathogens.

The hybrids differed in their tolerance to cold wet soil conditions. Seed of the tolerant hybrids consistently gave higher germinations than seed of the susceptible hybrids. Germination of the tolerant hybrids was not seriously injured by four days of cold at 32° F and 40° F regardless of the stage of germination. Eight days at either 32° F or 40° F did not seriously reduce germination of the tolerant hybrids until the seeds had been under favorable conditions for three days prior to cold treatment. Germination of the susceptible hybrids was reduced by all cold treatments at all stages of germination. Exposing seed corn to cold

temperatures for eight to twelve days, immediately or one or two days after planting appears to be a satisfactory method for evaluating cold tolerance.

Seeds for the same five hybrids were cold tested at 40° F in samples of a Brookston silt-loam soil and a Hillsdale sandy loam soil from crop rotation experiments. Cold test germination percentages differed depending on the soil type and the previous crop grown in the soil. In the Brookston soil, germination was best in soil that had previously been in wheat and decreased progressively in soils that had previously been planted to barley, beans, alfalfa, sugar beets, corn, and sweet clover. In the Hillsdale soil there were no significant differences in germination in the soil samples that had previously grown corn, wheat, and sweet clover.

Soil sterilization decreased injury to germination but did not result in perfect stands. Part of the reduction in germination may have been caused by cold injury at 40° F. Drying out of the soil before its use for cold test germination seemed to have an adverse effect on the soil pathogens responsible for cold germination injury.

S₀, S₁, and S₂ seeds for 41 families from a cold tolerant double-cross hybrid were cold tested at the same time in one experiment. Cold test germination decreased with inbreeding. Variability was greater between lines than within lines, indicating that selection would be relatively more effective between lines than within lines. Intergeneration correlations for germination indicated that early generation testing may be effectively used in selecting cold tolerant inbred lines.

52 pages. \$1.00. Mic 56-321

THE EFFECT OF PLANTING RATES AND NITROGEN LEVELS ON WINTER WHEAT VARIETIES WITH DIFFERENT MORPHOLOGICAL CHARACTERISTICS

(Publication No. 15,253)

Johnny Wryas Pendleton, Ph.D.
University of Illinois, 1955

Field investigations, designed to obtain information on the response of four winter wheat varieties with different growth characteristics to varying rates of planting and different nitrogen levels, were conducted over a three-year period (1953-1955) in southern and central Illinois.

Agronomic Results

A six-peck per acre seeding rate returned the highest net yield as an average for all trials. An increase in planting rate caused: a reduction in plant height, a reduction in plant erectness, a reduction in the stand of the interseeded clover crop, a reduction in the number of grain bearing heads per plant, an earlier heading date, a decrease in protein content of the grain, a decrease in kernel weight, and no general effect on test weight.

Statistical analysis of the yield results showed a highly significant difference in variety reaction to planting rate. However, the variety rankings for yield from the 6- to 18-peck seeding rates were always in the same order; one exception in this order occurred at the 3-peck rate.

The 60- and 90-pound applications of nitrogen per acre resulted in the highest yield. However, the yield superiority

was so small that when cost of nitrogen was considered, these two rates would not have returned a profit over the 30-pound rate. The increased yield due to a 30-pound nitrogen application was high enough to have returned a profit over the non-nitrated plots.

In general, an increase in nitrogen resulted in: a slight increase in plant height, a decrease in plant erectness, a sharp decrease in the stand of the interseeded clover crop, a slight delay in heading date, a decrease in kernel weight, an increase of protein in the grain, a slight increase in straw yield, and an increase in tillering. While statistical analysis of the yield showed varieties to react differently to rates of nitrogen application, the yield rankings were the same for the four varieties on each nitrogen level.

Morphological Results

The date of differentiation of the apical meristem of each variety in the spring was found to be an indication of their earliness. Each variety headed approximately 48 days after the spike began differentiating. Approximately 30 days before heading, the number of individual spikelets could be counted on each spike. The differentiation and development of the spike occurred progressively later as the rate of planting decreased, and as the nitrogen rate increased.

At Urbana, 78 percent of the stems had five elongated internodes, over 21 percent had six, and a few stems were found with only four. The average number of internodes per stem increased as the planting rate increased. Little difference in internode number resulted from the use of nitrogen. The two tall varieties averaged more internodes per stem than the short varieties. A higher average number of elongated internodes was found at Eldorado in southern Illinois than at Urbana in central Illinois. A breakdown of the height components for five internode plants showed each internode and the head to make up the following percentages: first internode, 6 percent; second internode, 11 percent; third internode, 15 percent; fourth internode, 23 percent; fifth internode, 38 percent; and the head, 7 percent.

The average leaf sheath length increased with each succeeding leaf from the lowest to the highest. The average leaf blade length showed an increase for each succeeding leaf up to the fourth and then a reduction in length in the fifth leaf. The leaf blade increased in width progressively from the lowest to the highest leaf. In general, leaf width increased as nitrogen rate increased and as planting rate decreased.

106 pages. \$1.33. Mic 56-322

A STUDY OF SPRAY DEPOSIT ON ONIONS

(Publication No. 15,531)

Herbert Ruckes, Jr., Ph.D.
Cornell University, 1955

A study was conducted with mist concentrate, low volume, and high volume spray applications. The study consisted of two parts: one, the determination of the type of deposit made by each method of application; two, the determination of the degree of pest and disease control obtained by each of the three methods. The former was accomplished by using fixed-copper compounds, as indicator

materials, to produce deposits that were evaluated by leaf prints and chemical analysis; the latter by a series of experiments using dieldrin for the control of thrips and zineb for the control of disease.

Mist concentrate applications of 10 and 20 gallons per acre were made with the Cornell experimental row mist sprayer utilizing an air blast to deliver the material to the plants. The low volume applications of 25 and 45 gallons per acre and the high volume application of 100 gallons per acre were made with a modified low pressure, low gallonage weed sprayer.

The data obtained from the deposit-studies indicated that the concentrate applications deposited more material on the distal area than on the middle and basal areas of the leaves; the deposits of the low volume applications appeared to be greater on the basal area than on the middle and distal areas of the leaves, while the high volume application produced a more even distribution of material but a relatively lighter deposit on all areas of the leaves.

A deposit-study experiment was used to determine the effect of rainfall on the redistribution of the residue. The results of this experiment indicated that the deposits produced by the concentrate applications appeared to be more easily redistributed down the surface of the leaves than those produced by the other two methods. The deposits of the low volume applications appeared to have a greater tenacity and were not as readily redistributed as the deposits of the concentrate and high volume applications.

Five experiments were conducted to evaluate insect and disease control. Thrips control data were obtained from four of these experiments, in one of which downy mildew also occurred; the fifth experiment yielded onion blast control data. The differences in the control obtained between the individual treatments was slight with an indication that the concentrate and high volume applications produced a slightly better control for thrips. In all cases, however, the degree of control obtained was highly significant compared with untreated check areas.

70 pages. \$1.00. Mic 56-323

MINERALOGY AND GENESIS OF SOME RHYOLITE DERIVED SOILS OF NEW ZEALAND

(Publication No. 14,745)

Leslie Denis Swindale, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Marion L. Jackson

A study of soil formation from rhyolite was undertaken to provide information regarding soil genesis and weathering in a soil suite where the parent material is virtually constant. Four residual soils which showed a sequence of increasing weathering and increasing soil development were selected for the study. The soils were: Kiokio fine sandy loam (weakly weathered), Maungarei clay loam (moderately weathered), Pukenui silt loam (moderately podzolised), and Parahaki sandy loam (podzol).

Samples were taken from the main horizons of the soils, and the mineralogical compositions of the sand, silt and clay fractions of the horizons were determined using a combination of X-ray diffraction methods, chemical analyses,

cation exchange capacities, specific surface areas, heating-weight loss data, and petrography.

The sand and silt fractions of all four soils were composed mainly of silica minerals with smaller amounts of feldspars occurring in the sands. The mineralogical compositions of the clay fractions differed from soil to soil, and, in the more developed soils, from horizon to horizon. They showed a relationship to the degree of weathering and to the degree of soil development as determined from environmental considerations.

Illite (28 percent), kaolin (21 percent), and quartz (20 percent) were the major constituents of the clay fractions of the A horizon of the Kiokio soil. Kaolin (75 percent or more) was the main constituent of the clay fractions of the Maungarei soil. Quartz was the main constituent of the eluvial horizons of the podzolised soils. The clay fraction of the illuvial horizon of the Pukenu soil was dominantly (70 percent) kaolin, while those of the two main illuvial horizons of the Parahaki podzol contained 33 percent of gibbsite and 56 percent of kaolin respectively. The C₁ horizon of the Parahaki soil contained an unusual form of cristobalite which contained approximately 25 percent of Al₂O₃ and had a cation exchange capacity in excess of one milliequivalent per gram.

These results, the morphologies of the profiles and their particle size distributions have been explained in terms of two soil-forming processes. The mechanism of the first process is one of solution. The process causes the removal of basic cations and of silicon, and the relative accumulation of aluminum, iron and titanium. The mechanism of the second process which causes the removal of aluminum, iron and titanium, is one of chelation and solution.

The action of the first process upon rhyolite causes the successive appearance of micas, expanding layer silicates, kaolin, and gibbsite in the clay and the gradual accumulation of silica minerals. The second process, which is dependent upon the nature of the vegetation, is superimposed upon the first at the stage represented by the Maungarei soil, and the two processes acting together cause the gradual removal of all the aluminosilicate minerals and of oxides other than those of silicon. In the Parahaki soil, where both processes have been highly effective, there is over 90 percent of the silica minerals quartz and cristobalite in the silt and clay of the top three horizons.

Three indexes of soil formation were examined in the study. The weathering mean was found to give a good indication of the particle size function of weathering but not of other weathering functions. Total zirconium gave good indications of soil development in the first two soils but became mobile under the influence of the second soil-forming process in the last two soils. The quartz contents of the clay (less than two microns) fractions gave adequate indications of the degree of soil formation in all four soils.

203 pages. \$2.54. Mic 56-324

MEASUREMENT OF FORMS OF SOIL MAGNESIUM AND THE SOIL MAGNESIUM REQUIREMENT

(Publication No. 15,279)

Billy Bob Tucker, Ph.D.
University of Illinois, 1955

Current procedures for the analytical determination of magnesium were investigated. It was found that the flame spectrophotometer has limited value in determining magnesium unless special equipment, such as a special burner, a photomultiplier tube, and a hydrogen flame source are available. It was also found that spectrophotometric detection of the end point in EDTA titrations of magnesium is not feasible on a routine basis unless expensive automatic recording devices are available. The colorimetric determination of magnesium by the use of Eriochrome Black-T was limited due to the narrow range and because the procedure was not reproducible. The most satisfactory method of determining magnesium was titration with EDTA after calcium had been removed. Separation of the calcium from the magnesium by precipitation as calcium tungstate was superior to separation as sulfate or oxalate.

Four soil samples representing three stages in maturity and samples representing the three major clay types were used in this investigation. Magnesium was extracted from these samples in equilibrium and leaching systems with the use of various extractants. Other variables in the study included: (1) sample:extractant ratio, (2) shaking time, and (3) soaking period. In an equilibrium system slightly more magnesium was extracted from the soil samples with neutral 1 N NH₄Ac than with 23 percent NaNO₃, but the difference in amount extracted between the two extractants was not important. The effect of the period of contact was relatively insignificant for the soils studied, when neutral salts were used. Increasing the shaking time increased the amount of magnesium extracted, especially when a narrow soil:extractant ratio was used. Roughly 70 percent of the total exchangeable magnesium was extracted from the soils when a 1:2 ratio of 23 percent NaNO₃ was shaken for 10 minutes; whereas, approximately 90 percent was extracted with a 1:20 ratio. Weak solutions of HCl and CH₃COOH did not remove the same percentage of the exchangeable magnesium from all soils studied. The amount removed by these acidic solutions depended upon the amount of cations present (i.e., the cation-exchange capacity of the soil). Results from the leaching study indicated that, for most Illinois soils, leaching the samples with a 1:50 (soil:NH₄Ac) ratio was sufficient for quantitatively determining the exchangeable magnesium. More magnesium was extracted from the soils with dilute HCl than with either NaNO₃ or NH₄Ac upon successive extractions, indicating that some form of magnesium other than "exchangeable" was extracted from these soils. This nonexchangeable form increased with increasing maturity of the soil. Two possible sources of this acid-soluble magnesium are: (1) magnesium that occurs between the crystal lattices of the clay mineral can be extracted by dilute HCl, especially if the mineral is highly weathered, and/or (2) magnesium occurs as a difficultly soluble salt such as MgSiO₃. This acid-soluble magnesium may be important in replenishing the exchangeable magnesium removed by crops.

Four soils, three of which represent a definite stage in the "Illinois Maturity Series" were saturated with calcium and magnesium and mixed to give ratios which ranged from

1:5 to 50:1. The cation-exchange capacity ranged from 4.0 to 29.0 me./100 gm.; therefore the amounts of calcium and magnesium varied among soils even though the ratio of Ca:Mg remained constant. The yield and chemical composition of soybeans grown on these treated soils in the greenhouse were determined. Varying the Ca:Mg ratio from 50:1 to 1:5 had no influence on the yield of soybeans grown on the soils high in cation-exchange capacity, but did influence the yield of soybeans grown on soils with low exchange capacities, indicating that the Ca:Mg ratio was not important as long as there were sufficient amounts of calcium and magnesium present in the soil. The absorption of calcium and magnesium was influenced by the amount of calcium or magnesium in the soil, and the absorption of potassium was influenced by the Ca:Mg ratio when the soil has a high cation-exchange capacity. The percentage of

phosphorus in the plants was increased significantly as the Ca:Mg ratio decreased and the amount of available magnesium increased sufficiently to be equal to, or greater than, the amount of calcium. When calcium exceeded magnesium, increasing the magnesium had little influence upon the concentration of phosphorus in the soybean plants.

Soybean cotyledons were found to contain a high concentration of magnesium and this source may furnish soybeans with a large part of the magnesium actually needed to carry out the metabolic functions specific to magnesium. If sufficient calcium and potassium is present to carry out those functions common to calcium, potassium, and magnesium, then the plant may produce normally even though the concentration of magnesium in the plant is low.

138 pages. \$1.73. Mic 56-325

ANATOMY

TISSUE CHANGES IN THE BRAINS OF CATS AND MONKEYS FOLLOWING COBALT 60 RADIATION

(Publication No. 14,758)

George Pierce Bogumill, Ph.D.
The University of Wisconsin, 1955

Supervisor: Associate Professor Paul H. Settlage

A method for producing lesions in the brains of experimental animals using radioactive cobalt has shown great promise as a means of elucidating the anatomical location of areas concerned with various aspects of behavior. Since relatively marked behavioral alterations occur in animals following the induction of lesions which grossly appear to be small and relatively discrete, it was considered important to obtain precise information concerning the histological changes occurring in the brain following radiation by this method. For this purpose, areas of the cerebral cortices of cats and monkeys were radiated utilizing as a source a small seed of cobalt 60 fastened into the tip of a 17-gauge needle. A standard dose was employed, and was identical for the two species. The animals were sacrificed at intervals of zero to 256 days, and the lesions were studied microscopically.

The radiation produced complete liquefaction of all elements (neural, glial, and vascular) for a short distance immediately around the radiation source. Very soon vascular degeneration resulted in hemorrhage and edema. Gitter cells removed the debris, and fibroblasts and astrocytes combined to produce a fibro-glial scar. Secondary necrosis was found at 64 days around the original defect, and focal areas of perivascular demyelination appeared at 96 days in the white matter at a distance up to 10 or more mm. from the center of the initial lesion.

The size of the lesion was substantially larger in the monkeys than in the cats. Such a species difference was interpreted as possibly having been due to a more severe hypoxia in the cat cortex during the radiation, which in turn may have been the result of response to the anesthetic. It was also suggested that the lack of congestion around the radiated area in cats may have been a factor.

The radiation produced a direct injurious effect upon all elements near the cobalt source with deterioration of the blood vessels followed by hemorrhage and marked edema. The vessels and neurons appeared to be more or less equally sensitive, although isolated damaged neurons are seen up to two mm. further than the maximum extent of the area of blood vessel damage. Of the three elements (neural, vascular, or neuroglial), the astrocytes appear to be the most sensitive.

Delayed necrosis occurred around the periphery of the initial defect prior to 64 days, and in the white matter as focal areas between 64 and 96 days. A progressive change resulting in thickening of vessel walls with resultant impairment of nutrition of the tissue is suggested as one possible cause of the necroses, and alterations in myelin without outward physical change in appearance for long periods is suggested as another.

111 pages. \$1.39. Mic 56-326

ANTHROPOLOGY

HUALCAN: AN ANDEAN INDIAN ESTANCIA

(Publication No. 15,534)

William Warner Stein, Ph.D.
Cornell University, 1955

This thesis is a community study of an independent land-owning, Quechua-speaking Indian village in Carhuaz District, Department of Ancash, Peru. Emphasis is placed on the goal of understanding the human potential of Hualcan, as a representative community in this "underdeveloped" region of the world. The Hualcan institutional areas of economy, family, political organization, and religion are examined in terms of socio-cultural integration and cleavage.

Hualcan is a small agricultural community. Every resident, including even the few specialists, is an agriculturalist. There is not sufficient land to maintain everyone. Over half the households of Hualcan have either to furnish peones for labor on neighboring haciendas in exchange for more land or to send members outside the community for wage labor.

The family system is based on the patrilineal lineage and the kindred groups. Households are generally larger than nuclear families. Families are linked together by marriages and by ceremonial kinship ties which are established in connection with life-crisis rituals.

Community leadership is exercised by a body of politico-religious leaders. This organization is in charge of the communal tributary labor system and performs important functions throughout the ceremonial cycle. The Peruvian National political system is represented in Hualcan by a local appointee. Hualcainos prefer to have as little as possible to do with the outside.

The religious system, particularly the fiesta system, knits the community together through the institution of ceremonial assistance. The Patron Saint of Hualcan, Santa Ursula, has her group of stewards and their assistants who all have important ritual obligations. God is distant, and Santa Ursula is the most immediately important supernatural being for the Hualcainos. She intercedes for them before God, her relative. God has destined the world to be as it is, but one's position in life can be changed if one accepts one's lot and leads a "good" life.

Hualcan culture is summarized in terms of the following fifteen themes:

1. Because the world exists in its present form through God's will, man must accept his destiny.
2. Man has to contend with good and evil forces in the universe which can harm him, but which he must use.
3. God's help is necessary, but man must approach God indirectly. His attention is to be sought through intermediaries.
4. It is highly desirable to be self-sufficient.
5. One has to depend on relatives (who exist by God's sanction).
6. Gratification may be achieved only through great effort. Man is required to exert himself.
7. Once a compact is made, it must be validated by the performance of both parties with respect to it. Man must assume responsibility for the consequences if he fails to perform in terms of the compact.
8. Good and bad things have to be shared by those persons who are important to each other.
9. Status is validated by contribution.
10. Men are stronger than women, physically and mentally.
11. Women are the gate-keepers of gratification.
12. Status is validated by age.
13. The outside world becomes increasingly dangerous the farther one moves from one's family. It is not to be trusted.
14. One should extend one's relations to other Indians, since they share a common destiny with one.
15. The important life-goal is tranquilidad.

As a conclusion, themal integration in Hualcan is examined in the light of its potential for cultural change. A case of the attempted introduction of a new technique is analyzed in terms of themes and their expressions in institutional contexts.

454 pages. \$5.68. Mic 56-327

ASTRONOMY

STUDIES ON SOLAR GRANULATION (Parts I and II)

(Publication No. 13,728)

Andrew Skumanich, Ph.D.
Princeton University, 1954

This study is divided into two parts. The first part concerns the possible existence of a statistical asymmetry between bright and dark in granulation intensities. On each of two sample fields selected on two direct photographs of the quiet sun, taken with the 60-foot tower telescope of the Mount Wilson Observatory, two isophotes were chosen so that the total bright region (i.e. brighter than the isophote) formed 20% and 80% of the total area of the field, respectively. The frequency size distribution of singly connected regions for both isophotes (bright on the 20% and dark on the 80% isophote) were obtained and intercompared. A slight excess of bright regions implied a slight — if any —

bright asymmetry but certainly not as strong as the rice-grain picture implies. This conclusion refers only to the sizes resolved on the plates.

The second part treats thermally induced convection in a polytropic atmosphere with a strong density variation from top to bottom in regard to its implications on element sizes in solar granulation. It is found that — contrary to the classical case of a homogeneous atmosphere — in the absence of viscosity and heat conduction, the square of the speed of development of a perturbation varies inversely as the horizontal wavelength of the perturbation for wavelengths shorter than the depth of the unstable zone. Thus in the solar hydrogen convection zone small element sizes are to be expected to predominate. The introduction of physical complications such as viscosity (and hence conduction) does not make the problem prohibitive for numerical analysis.

43 pages. \$1.00. Mic 56-328

BACTERIOLOGY

SOME IMMUNOLOGICAL ASPECTS OF PASTEURELLA MULTOCIDA IN THE CHICKEN

(Publication No. 15,181)

Paul Brown Barto, Ph.D.
University of Illinois, 1955

A comparative study was made of the protection conferred by a variety of killed vaccines. Broth, chick-embryo (both formalin-killed), sonic-disintegrated, ultraviolet-inactivated, broth-adsorbate, and sonic-disintegrated adsorbate vaccines were prepared. Mineral-oil emulsions of broth, broth adsorbate, sonic-disintegrated adsorbate, and chick-embryo vaccines were also prepared.

Vaccination of 3- to 6-month chickens followed by challenge with virulent *Pasteurella* organisms of the homologous strain (with one exception) gave results from which the following conclusions have been drawn:

1. A formalin-killed-broth vaccine of Strain 6-7 conferred greater immunity than a formalin-killed-chick-embryo vaccine against challenge with the homologous strain.
2. No significant protection was afforded by either of these vaccines against a heterologous challenge strain.
3. Formalin-killed-broth-adsorbate vaccine offered better protection than formalin-killed-broth vaccines or vaccines killed by physical treatment.
4. Mineral-oil-emulsion vaccines conferred greater immunity than the plain vaccines.
5. At best the immunogenicity of Strain 6-7 was not

very great. The immunity which had been produced disappeared very rapidly.

6. Based upon the results of these experiments, further study with the mineral-oil vaccines is warranted.

P. multocida (Strain 6-7) dissociated into a mixture of blue and fluorescent forms *in vivo*, particularly in the chronically infected bird. *In vitro*, dissociation was easily induced by 10 to 15 serial passages in infusion broth and was brought about even more readily in broth to which 0.25 percent lithium chloride had been added.

The blue and fluorescent types produced similar biochemical reactions but differed in growth properties in broth containing considerable carbohydrate. In this medium the blue type autoagglutinated readily, but the fluorescent type remained in suspension. Total growth and acid production in this medium was greater for the fluorescent than for the blue type.

Nine serial passages in 9- to 14-day chick embryos receiving separate initial inocula of blue, fluorescent, and a mixture of the 2 types revealed that both types retained their typical colonial characteristics and that no reversion of the blue to the fluorescent type occurred. The ninth passage of the mixed types contained the blue and fluorescent forms in about the same ratio as the original inoculum, although fluctuations in proportions of the two had occurred from passage to passage. The fluorescent type was more pathogenic for chick embryos than the blue type.

A tryptose-sucrose agar medium was found to be best for observation of blue and fluorescent forms. A greater contrast between golden and blue coloration developed when both types were cultivated on the same plate of medium.

Electron micrographs of 16-hour cultures revealed the presence of a substance resembling capsular material in the fluorescent type but not in the blue type.

102 pages. \$1.28. Mic 56-329

STUDIES ON THE ACTINOMYCINS WITH EMPHASIS ON ACTINOMYCIN D

(Publication No. 14,039)

Francis Joseph Gregory, Ph.D.
Rutgers University, 1954

The actinomycins are now recognized as a family of antibiotics unique among natural products in possessing a polypeptide attached to a quinoid chromophore. On the basis of paper chromatographic separation and counter-current distribution, the actinomycins isolated from microbial filtrates have been demonstrated to be complexes consisting of two or more pure actinomycin components. This study concerns itself with a comparative investigation of the various members of the actinomycin family with emphasis on a new actinomycin, actinomycin D, obtained from a new species of *Streptomyces* isolated in the course of these investigations. The physical and microbiological properties of actinomycin D as well as its toxicity for the laboratory mouse were also examined in some detail.

Conventional microbiological techniques were employed for the production of the actinomycins and a variety of complex media were screened for optimal yields of the antibiotic. Advantage was taken of the adsorption properties, solubilities and partition coefficients of the actinomycins for the extraction of the antibiotic from the culture media and its subsequent purification.

Several methods for the extraction and purification of the actinomycins are given and two of these were routinely used with success. One relies on solvent extraction from the broth and the solubility properties of the antibiotic in various organic solvents. The preferred procedure consists of adsorption on charcoal followed by selective elution. The material thus obtained was purified on a silicic acid column and crystallized from mixtures of absolute ethanol and petroleum ether.

Paper chromatography, using the circular, ascending, and descending methods followed by densitometer scanning of chromatograms was used for quantitative evaluation of the components in each complex, in order to achieve a classification of the actinomycins. Paper chromatography was also used to study the degradation and inactivation of the actinomycins. A mixture of naphthalene-2-sulfonic acid, ethyl acetate, and n-butyl ether was found to be the most useful solvent system.

The results indicate that a new species of *Streptomyces*, *S. parvullus*, is capable of producing an actinomycin that is homogeneous in solvent systems which successfully separated the other actinomycin complexes into their components.

The results of chemical analysis of actinomycin D are presented and an empirical formula of $C_{80}H_{76}O_{15}N_{12} \cdot 3H_2O$ is proposed. The amino acids proline, sarcosine, valine, N-methyl valine and threonine have been found in this antibiotic. The method of Reed and Meunch was employed for the determination of the LD_{50} of actinomycin D for the

laboratory mouse. It was found to be very toxic with an LD_{50} of 0.67-0.74 mg/kg by intravenous route. It caused the dramatic reduction in spleen size that is typical of the actinomycins.

The medium found best for the production of actinomycin consisted of 2% soya-peptone and 1% glucose. A combination of charcoal and silicic acid adsorption followed by selective elution were used for the extraction and purification of the antibiotic.

Actinomycin was degraded by acid and alkaline hydrolysis or by aerial oxidation to microbiologically inactive, non-toxic substances. The degradation product of aerial oxidation fluoresced markedly in ultra violet light.

On the basis of these comparative studies it was possible to divide the known actinomycins into five major groups:

- The original actinomycin A (1940) type of complex.
- The actinomycin B type of complex.
- The actinomycin C type of complex.
- Actinomycin D.
- The actinomycin I type of complex.

127 pages. \$1.59. Mic 56-330

A STUDY OF THE BIOLOGY OF CERTAIN INTESTINAL ASSOCIATES OF RETICULITERMES FLAVIPES

(Publication No. 15,334)

Hope Thomas Martin Ritter, Jr., Ph.D.
Lehigh University, 1955

A. Statement of the Problem.

The problem has three major aspects:

- the identification of organisms inhabiting the hind-gut.
- the development of a culture medium for micro-organisms.
- the determination of species responsible for cellulolytic activity.

B. Procedure.

Morphology and taxonomy.

Protozoa in 0.35% NaCl are observed with dark contrast phase microscopy. Observation is supplemented by using intestinal smears fixed in Bouin's solution, stained with protein silver and counterstained with iron hematoxylin.

The development of a culture medium and the observation of cellulolytic activity.

Various bactericidal agents were compared in an attempt to develop a method for sterilizing the external surface of termites before removing the hind-gut for inoculation.

A chamber of plastic material made it possible to study the influence of varied media on in-vitro nearly anaerobic growth of hind-gut microorganisms in an atmosphere of nitrogen gas. Influence of various nutrients was appraised by:

- change in the protozoan population with time.
- change in hydrogen ion concentration and its influence on protozoan growth.
- dominant bacterial species.
- alteration of cellulose content in the media.

Mineral oil as an anaerobic seal for culture tubes was also investigated using the above criteria, and growth in oil-layered tubes in air and in a nitrogen atmosphere was compared.

C. Results.

Species of the following genera occurred with reasonable regularity in the hind-gut of worker termites:

| | |
|--------------------------|-----------------------|
| <u>Dinenympha</u> | <u>Holomastigotes</u> |
| <u>Pyrosonympha</u> | <u>Joenia</u> |
| <u>Trichonympha</u> | <u>Microjoenia</u> |
| <u>Spirotrichonympha</u> | |

Two expected genera, Trichomonas and Hexamastix are not reported. Two species of Dinenympha and one species of Holomastigotes have been found for which no taxonomic description is available.

Adequate surface sterilization was obtained by immersing termites in 1:800 mercuric chloride (45 minutes), 75% alcohol (20 minutes), and in several rinses of sterile distilled water. Over half of the test plates, exposed to termites sterilized in this way, showed no bacterial growth. Species appearing can also be isolated from the hind-gut.

Those media which reduced hydrogen ion change and which excluded oxygen proved best.

Cellulose inclusions are visible within the cytoplasm of most species of protozoa, yet protozoan cultures showed no observable cellulolytic action.

A strict anaerobic spore forming bacterium, Clostridium omelianski, appeared in all oil-sealed cultures maintained in a nitrogen atmosphere. Complete hydrolysis of two per cent cellulose occurred within ten days. A large spiral bacterium was also found in these cultures.

D. Conclusions.

This work demonstrates the chaotic condition of the taxonomy of this group of protozoa. It is probable that two new species of Dinenympha and one new species of Holomastigotes have been found.

Present methods fail to demonstrate cellulose decomposition by the protozoa alone. The cellulolytic activity observed in these experiments seems to be the result of bacterial action since several species of bacteria are present.

Since the protozoa showed considerable ability to survive, even in the presence of facultative bacteria, there seems to be some justification for questioning the long established belief that these protozoa require a strictly anaerobic environment. It seems equally probable that these protozoa grow best in an environment which inhibits the growth of facultative microorganisms. The reduction in hydrogen ion concentration by these bacteria is unfavorable for protozoan growth.

166 pages. \$2.08. Mic 56-331

PART I. THE PRODUCTION OF HYALURONIDASE BY BALANTIDIUM COLI.

PART II. THE EFFECT OF X-IRRADIATION ON TRYPANOSOMA LEWISI INFECTION IN THE RAT.

(Publication No. 14,746)

Constantine Harry Tempelis, Ph.D.
The University of Wisconsin, 1955

Supervisor: Associate Professor Michael Lysenko

Once Balantidium coli has become established in man, it may attack the epithelial surface of the large intestine, burrow into the wall, and produce ulcers. The ability of

this protozoan to penetrate the mucosa and establish itself may depend not only upon mechanical factors but also upon some factor or factors produced by the vegetative organism.

The purpose of this investigation was to determine possible biological ways in which B. coli is able to bring about its pathogenic effects.

The strain of B. coli used in these experiments was derived from a clone culture obtained by microisolation from the hog. To check the hyaluronidase activity of this organism two substrates were used: (1) the capsular material of M-4 strain of group C streptococcus and (2) potassium hyalurate. The presence of hyaluronidase activity was determined by observing the decapsulation of the streptococcus and by use of the Mucin Clot Prevention test.

These two substrates were acted upon by the balantidia when they were incubated together at 37° C. for designated intervals. Controls consisting of the associated bacteria showed no hyaluronidase activity. The results of these two experiments indicate the presence of hyaluronidase in B. coli, and a possible secondary mechanism by which this organism is able to enlarge the lesion.

There is considerable evidence showing that immunity is broken down under the influence of X-irradiation. Probably the outstanding conclusions to be drawn from the experimental data is that all types of microorganisms proliferate more easily in animals treated with sub-lethal doses of X-ray.

In this investigation the course of infection in rats treated with single and multiple doses of X-rays and infected with T. lewisi was studied. In addition the effect of X-irradiation on the immune response of the rat as measured by the production of agglutinins, and blood sugar levels during the course of the infection were determined.

All animals used in this work were albino rats of the Wistar strain. All X-irradiated animals received 300 r except those in experiment II, these animals received an additional 200 r, and were infected 24 hours later.

Agglutinins were titrated with trypanosomes suspended in a buffered glucose solution pH 7.4 at an optical density of .320 at 620 mu in the Coleman Junior Spectrophotometer. Twofold dilutions of the immune serum were prepared, and 0.1 ml of trypanosome suspension was added. The tubes were allowed to stand at room temperature for two hours. The results were recorded in the conventional manner as 4+, 3+, etc.

Blood glucose levels were assayed in four groups of rats: (1) normal, (2) infected, (3) X-irradiated, and (4) X-irradiated and infected. Tail blood was collected in spot plate depressions containing 0.2 mgm per 0.1 ml of dried sodium oxalate. For analysis the method of Horvath and Knehr was followed.

Rats irradiated and infected exhibit a marked increase in parasitemia. The increase is particularly evident between the 5th and 7th days. At the peak of the parasitemia (11th day) there was a four-fold increase in the number of circulating trypanosomes as compared with the control groups. The extension of the infection was 12 days beyond that of the controls. A second exposure on the 5th and 10th days interfered with some unknown protective mechanism in the first, but not in the latter group. The second exposure produced no additional interference in ablastin or trypanocidal antibody production.

Agglutinin production was significantly inhibited for about 7 days as the result of X-irradiation, while the blood sugar

levels remained within normal limits for all groups until the 14th day when a hyperglycemia was observed in the X-irradiated and infected rats.

90 pages. \$1.13. Mic 56-332

UTILIZATION OF THE NITROGENOUS COMPOUNDS IN MILK BY LACTIC ACID BACTERIA

(Publication No. 14,749)

Homer Wayne Walker, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor E. M. Foster

Since lactic acid bacteria slowly increase the amount of soluble nitrogen in milk cultures, the idea has arisen that these organisms utilize the protein in milk poorly, if at all, as a source of nitrogen. It is believed, instead, that they depend on the small quantity of soluble nitrogen present in milk. This study was designed to establish by direct measurement of growth the utilization of individual nitrogenous constituents of milk by cultures of lactic organisms, and to determine the effect of pasteurization and autoclaving of the proteins on the growth of these organisms.

Nine cultures including *S. lactis* strains 171 and 23, *S. cremoris* 144F, *S. thermophilus* Mc, *S. liquefaciens* 3, *L. casei* strains 142, 65, and 25 and *L. lactis* 39a were tested. For use as the basal medium a milk serum was prepared by filtering fresh, raw skim milk through a collodion membrane of such porosity that all the protein compounds were removed. The serum contained between 200 and 300 micrograms (average 270) of nitrogen per ml and supported only a limited population of the test organisms.

The serum was buffered with 0.5 per cent sodium acetate. Individual nitrogen compounds were added and the reaction was adjusted to pH 6.5 when necessary. Plate counts of the organisms after 36 hours incubation in basal serum were compared with counts in the serum containing the added individual nitrogen compounds to determine whether utilization occurred. At least a two fold increase was taken as an indication of utilization.

Milk proteins were isolated from skim milk by use of procedures which minimized their denaturation. The calcium caseinate-calcium phosphate complex was obtained

by centrifugation. The proteose-peptone fraction was separated by differential ultrafiltration through collodion membranes. The other fractions were prepared by isoelectric precipitation and salting out at low temperatures. The non-protein materials were not isolated from milk but were used as pure chemicals of Reagent grade or better purity.

All of the organisms grew better in the presence of isoelectric casein, lactalbumin, or proteose-peptone than in the basal serum alone. With the nonproteolytic cultures, sodium caseinate, alpha casein, beta casein and beta lactoglobulin did not stimulate growth over that in the controls. *S. liquefaciens*, however, utilized all of the protein fractions.

The nonprotein nitrogen compounds generally were not utilized and frequently caused inhibition at the levels tried. *S. thermophilus* Mc was the only organism to be stimulated by ammonium chloride. The addition of urea caused stimulation of *S. thermophilus* and *S. liquefaciens* at low concentrations but at high concentrations *S. liquefaciens* was greatly inhibited. Except for *S. liquefaciens*, all the organisms exhibited no response or slight inhibition to the presence of creatine or creatinine in the medium. Growth of *S. liquefaciens* was stimulated by creatine but greatly inhibited by creatinine. Uric acid had little effect on any of the organisms.

The effect of pasteurization and autoclaving on the availability of the protein fractions was determined by using *S. lactis* strains 171 and 23 and *L. casei* strains 142 and 25. The heat treatments resulted in increased growth in the basal serum as well as with the protein fractions. One exception to this generalization was observed following pasteurization of beta lactoglobulin. This treatment resulted in less growth of *S. lactis* 171 and *L. casei* 142 than in the control.

No single compound in milk was found to be the chief nitrogen source for the lactic organisms. It is possible that the compounds must be present in combination before good growth is obtained. Also, it may be necessary to release utilizable nitrogen from the proteins by heating or some other treatment before milk becomes an entirely satisfactory medium for these organisms.

104 pages. \$1.30. Mic 56-333

BIOGRAPHY

CELIA THAXTER, POET OF THE ISLES OF SHOALS

(Publication No. 13,420)

Mary Dickson de Pizá, Ph.D.
University of Pennsylvania, 1955

Supervisor: Dr. Sculley Bradley

Voice of wind-swept islands off the coast of Portsmouth, New Hampshire, Celia Thaxter (1835-1894) produced a book of sketches, Among the Isles of Shoals; An Island Garden; Stories and Poems for Children; and a collected edition of Poems.

She was a transitional poet identified with regional and local-colorist writers of her time. Her work is autobiographical, picturing her childhood on White Island, Star and Appledore. Dramatic power of the ocean was in the foreground of all her poetry and prose. Vital and forthright in temperament, she had as tutor, Levi Lincoln Thaxter, Harvard graduate, whom she married. He introduced her to his friends and amplified her horizon when he removed his family to Newtonville near Boston.

New York and Boston literati were attracted to Appledore House built at the Isles of Shoals by the Loughtons. Celia Thaxter's cottage, close by her father's hotel, formed a gathering place for vacationing writers, musicians and artists.

John G. Whittier was influential in Celia Thaxter's literary development. Eighty-one letters to her from Whittier in the Roland Thaxter Collection at Houghton Library, Harvard University, attest to an interesting friendship. Among the Isles of Shoals would scarcely have been written, except for Whittier's insistence. Family burdens and extended absences of Levi Thaxter, eleven years his wife's senior and troubled with ill-health, made it difficult for Celia Thaxter to dedicate time to anything but her household. Whittier's reiteration that it was her "destiny to produce poetry," messages of praise and encouragement, solicitude concerning her personal problems gave her confidence and stimulated her creative possibilities.

Whittier, frequently at Appledore, was impressed by Celia Thaxter's beauty-loving personality seasoned with a dash of caprice. She was spontaneous, with zest for work and improvement and courage to experiment. Over-fervid though Among the Isles of Shoals may be, its distinguishing quality is authenticity. Celia Thaxter had a profound love of Nature and desire to communicate her changing moods.

Reflecting Whittier's religious atmosphere, she preferred the ballad measure which he liked and agreed with him on the moral-tag issue. The Nation, December 1896, stated that Celia Thaxter's poetry was like her island, "a scanty yield, yet taking rich tints and deeper fragrance from the tonic neighborhood of the salt air."

Celia Thaxter's flare for the dramatic, her art in story-telling moved Whittier to suggest themes for ballads, as "The Watch of Boone Island," and "Lars" for which he composed introductory stanzas. The ballads of Celia Thaxter,

often superior to her lyric poems, all have the sea as their setting. The former have virility with rapidly unfolding action, emotional tenseness, terse diction.

Letters of Celia Thaxter to family and friends possessed by Miss Rosamond Thaxter and the Boston Public Library Collection of one hundred twenty-seven letters from Celia Thaxter to Mrs. James T. Fields and Sarah Orne Jewett made possible additional material of literary merit hitherto unpublished.

A wistfulness or solitary quality predominates in the best poems of Celia Thaxter. Inarticulate yearning of childhood, unfilled ache of maturity are woven into the texture of poems like "Landlocked," "Footprints in the Sand," "At the Breaker's Edge," "Seaward," "Watching," "Off Shore," "The Sandpiper," "The Secret," and "May Morning."

Although a minor poet, Celia Thaxter stands for genuineness. She did not attempt innovations in form and preferred the quatrain with end-rhyme variations. While most of the feminine poets, over-literary and graceful, but without compelling force, engaged in sentimental, second-hand emotion, Celia Thaxter's work vibrated to the multiple impressions of her island, keyed to biting sea winds. She was not a dominating voice, as F. L. Pattee remarked, "but her verse is pervaded with the cry of one who loved the sea better than any other American who has ever written about it."

272 pages. \$3.40. Mic 56-334

THE POLITICAL CAREER OF ARTHUR H. VANDENBERG

(Publication No. 15,624)

Aurie Nichols Dunlap, Ph.D.
Columbia University, 1955

The story of Arthur H. Vandenberg is essentially that of the evolutionary transformation of an intelligent, ambitious man from a politician into a statesman, from an isolationist into an internationalist, and from a Republican partisan into a prime architect of "unpartisanship" in foreign affairs — a metamorphosis which was completed about 1945. In his early desire for political success he was apparently motivated, not by an urge to promote a cause, but by a craving for self-respect and the esteem of others, in his role as a legislative "hero," and for the political security which Senators tend to enjoy.

But his techniques were those of an individualist rather than those of the traditional party politician. Although he preached party regularity, he frequently left the "reservation" to propose "pet projects," to support eclectically Democratic measures, and to advocate coalition in time of crisis. Although he adhered intellectually to the doctrine of indirect democracy, he habitually appealed directly to the "grassroots," as an orator and political educator, in behalf of his candidacies and proposals. He was particularly adept

at finding compromise, "middle-of-the-road" solutions — substantive and procedural — which could win majority acceptance from Senators, party leaders, and voters, often in disregard of party lines.

His concept of "enlightened self-interest," roughly paralleling that of his Michigan constituents, gradually broadened under the impacts of the Great Depression and World War II, moving from "Michigan nationalism" through "American sovereignty and independence" to "internationalism" in quest of "peace with justice." As his vision expanded, his sense of mission slowly eclipsed his personal ambition and his political aptitudes and techniques, devoted to the cause of world peace and security, became more effective. Partly under his guidance and inspiration in the formulation and implementation of the philosophy, mechanisms, and procedures of the bipartisan approach to foreign policy, the Congress overwhelmingly approved unprecedentedly bold measures in the name of "peace with justice" and thus helped to establish postwar American leadership in the non-Soviet world. Thus, also, Vandenberg's "unpartisan" leadership won him far greater influence and prestige — at home and abroad — than he had achieved as a self-seeking, partisan politician.

The Michigan Senator never energetically sought the presidential nomination, largely because his personal pride and independence apparently would not let him connive or beg for the office, to follow the directions of party leaders, or to risk defeat at the hands of Franklin D. Roosevelt, and because he felt that he had found his niche in the Senate. By the time he had reached the peak of his popularity he was too deeply absorbed in the pursuit of an ideal to feel the attraction of high office; and his ambition ebbed as his health declined.

Vandenberg was an outstanding example of a new type of legislative leader which, together with the American electorate, has been undergoing a process of refinement in the fires of domestic and international crises. Impelled by the gravity of such emergencies, he repeatedly disregarded traditional and partisan considerations in favor of personal conviction based upon careful study of the problem under debate. Since compromise is normally the peaceful alternative to violence, the man who — like Vandenberg — can devise and "sell" the mechanisms, procedures, and substance of compromise can usually be regarded as playing admirably his role as a modern American political leader.

447 pages. \$5.59. Mic 56-335

PIERRE WIBAUX, BAD LANDS RANCHER

(Publication No. 14,941)

Donald Hugh Welsh, Ph.D.
University of Missouri, 1955

Supervisor: Lewis E. Atherton

Pierre Wibaux was born in Roubaix, France, in 1858. His father operated a large textile mill which had been founded by Pierre's grandfather in 1810. Pierre received a well-rounded basic education and then, to enable him to assume an active part in the management of the firm, he was sent to England to study British methods of spinning. While there, he heard stories of the range-stock business

in the American West and determined to examine these reports for himself.

Wibaux arrived in the United States in 1883 and visited Chicago to investigate the packing industry and to study market conditions at the stockyards. Then, in company with the Marquis de Mores, he travelled to the Bad Lands area of what is now Eastern Montana and Western North Dakota and claimed a ranch site. He formed a short-lived partnership in the cattle business with another Frenchman, Gustave Grisy, which was dissolved in 1884.

Wibaux ranched on a small scale until the fall of 1886. He then returned to France and, with the assistance of his father and brother, formed the Pierre Wibaux Company, capitalized at \$200,000. Returning to the United States in the spring of 1887, he purchased at a very moderate price large numbers of the cattle which survived the hard winter of 1886-1887. His ranch, the W, operated at its peak during the early 1890's when about 65,000 cattle roamed its range annually.

During the early 1890's, Wibaux became involved in extended litigation with Nelson Morris, the Chicago packer. Morris contracted to purchase many cattle on the range in anticipation of a rising market. Cattle prices, instead, began to decline and Morris attempted to evade his obligations. Wibaux, who had contracted to sell his dry cows and mature steers to the packer, brought suit against Morris and recovered damages.

Shortly after the turn of the century, the influx of homesteaders forced Wibaux to close out his cattle interests. He devoted the remainder of his life to travel and to supervision of his financial interests, principally the State National Bank of Miles City, Montana, of which he had been chosen President in 1896.

Wibaux succeeded in his ranching activities when many others failed because he proceeded in a careful and intelligent fashion, because he had adequate financial backing, and because at times fortune seemed to smile upon him. His neighbors coined the term, "Wibaux's luck," in speaking of some of the fortunate events which befell him.

Wibaux, a progressive rancher, was unhampered by tradition. He made a careful study of livestock markets to determine the types of cattle most in demand and the best methods of marketing them. He raised calves on his own range when most ranchers on the Northern Plains stocked yearling steers from breeding centers elsewhere. He seeded a field to alfalfa in 1887, the first to be planted in Beaver Valley. He did this in order to have feed to carry his horses and a part of his stock through the winter. Most successful ranchers today follow this same practice. He joined with his neighbors in the war against prairie fires and wolves and inaugurated new methods in battling both menaces.

Pierre Wibaux died in Chicago, Illinois, in 1913. The people of Eastern Montana honored him by naming a town and a county for him, and in Miles City a block and a park help to perpetuate his name.

311 pages. \$3.89. Mic 56-336

BIOLOGY - GENETICS

GENERAL PHYSIOLOGY AND ELECTRON MICROSCOPY OF YOUNG AND MATURE RABBIT ERYTHROCYTES

(Publication No. 15,645)

David Chalfin, Ph.D.
Princeton University, 1955

Rabbit young red blood cell production was enhanced by causing anemia with repeated hemorrhage. Fractionation of the young cells (reticulocytes) from the mature erythrocytes was accomplished by means of centrifugation.

The distribution of several physiological properties along the length of a packed cell column of centrifuged anemic blood has been investigated.

The young cells are found at the top of the packed cell column and the mature cells at the bottom. The younger cells have a lower bulk density than the mature cells. The young cells are about 1.5x as large, contain more solids, but percentagewise have a greater per cent of water than the older, mature cells.

The hemoglobin content per cell as recorded by the optical density at 544 m μ in association with cell counts indicate that all the circulating rabbit erythrocytes have the same amount of hemoglobin.

The young red cells contain about 1.5x more potassium per cell than the mature cells; however, the potassium per liter of cell water (Potassium concentration) is the same in both the young and mature cells. The sodium content is about the same in both the young and mature cells.

Young cells are more resistant to osmotic hemolysis than are mature cells. The volume and shape of the cells are implicated as responsible, in part at least, for the osmotic resistance difference.

Electron micrographs of sections of rabbit erythrocytes both young cells and mature cells are presented. The cell membrane has been observed to be about 65 Å thick in micrographs of young cells, mature cells and sections of ghosts of each of these. Intracellular structures have been revealed in the young cells. Some of these structures are large enough to be within the limits of resolution of the light microscope. Mitochondria-like structures with double layered membranes, granules containing osmophilic material and vacuoles have been discerned. In addition, small structures such as "surface indentations", "small rings" and "hollow" structures at the surface of the cell have been noted.

Developmental changes resulting in the maturation of the rabbit circulating erythrocytes are discussed.

87 pages. \$1.09. Mic 56-337

THE EFFECT OF ENVIRONMENT ON THE EXPRESSION OF HEREDITARY RESISTANCE TO SALMONELLA PULLORUM IN CHICKENS

(Publication No. 15,214)

Syam Ranjan Guha, Ph.D.
University of Illinois, 1955

A series of experiments was conducted to ascertain the effect of various levels of protein and of productive energy in the feed on the growth rate of chickens and on the degree of resistance to artificially induced infection by S. pullorum. Attempts were also made to determine whether the degree of resistance to pullorum was related to the lymphocyte count, the spleen weight or to the body temperature of the chicks.

It was observed that with feeds adequate in other respects, 21% protein gave the highest growth rate followed in order by 26%, 16% and 11% protein diets. The rate of growth of chicks did not run parallel to the degree of resistance to pullorum. A diet containing 21% protein but low in productive energy produced a higher growth rate than a diet containing 11% protein and high in energy value but the resistance was poorest in the chicks fed the former ration.

No significant association was observed between degree of resistance and number of lymphocytes in the blood or the spleen weight of the chicks. A certain amount of association of body temperature of the chicks and degree of resistance to S. pullorum was noticed.

76 pages. \$1.00. Mic 56-338

A PRELIMINARY STUDY OF THE OPPORTUNITIES PRESENTED BY A POND AS A LABORATORY FOR PRE-COLLEGE BIOLOGY

(Publication No. 15,602)

William Joseph Hoover, Ph.D.
Cornell University, 1955

The title suggests what the author attempted to develop. His is one of a series of studies to explore the educational value of specific areas.

A pond 186 feet long and 150 feet wide near Ithaca, New York, was used for the study. Surrounding areas to a distance of ten feet from the normal fall water line were included. The area was studied first "in toto", including plants and animals, and physical and chemical characteristics. Studies of specified areas followed. The ecological viewpoint was stressed. A section was devoted to applications of the study. A photographic record of seasonal changes was included. The characteristics of the pond, its geographic location, the time devoted to field work, and the scope and methods of the study, imposed limitations.

Materials and methods simple enough for students at a

pre-college level were emphasized. 117 species of vascular plants were recorded, a list by no means complete but representative of ponds in the Transitional Life Zone of the northeastern United States. One flatworm, 2 segmented worms, 4 molluscs, 4 crustaceans, 35 insects, 13 amphibians, 4 reptiles, 47 birds, and 16 mammals were recorded together with ecological data.

A study of the physical and chemical factors included the geographic location, and analyses of temperature conditions, oxygen content, pH concentration, turbidity, and water fluctuation.

Special studies were made of a Typha zone, a meadow zone, and a wooded zone.

Applications of the study included consideration of the use of the pond as a laboratory and source of materials for high school biology courses. Methods of observing and recording, and of mapping were presented as well as various ways to study plants and animals, and to measure certain chemical and physical factors.

A twenty-four study was suggested as a means of learning more about diurnal relationships. Studies of this nature carried on throughout the year would contribute to a better understanding of seasonal changes.

Ponds offer opportunity for experiments and direct experiences that can profitably be related to many of the concepts offered in pre-college biology or conservation programs.

Ponds are numerous in many areas and relatively accessible to many high schools. They can be used satisfactorily as laboratories to demonstrate many of the principles developed in biology and in conservation programs.

Ponds everywhere are similar. Animal and plant groups recorded in this study are found in most other ponds, although species may differ. The methods used may be used anywhere. Each pond is a combination of physical, chemical and biotic factors, the interaction of which determines its success as an aquatic habitat.

The author has suggested in this study some ways in which teachers and students of biology may observe, investigate, and enjoy a pond, with the hope that from the combination of these three activities students well versed in the study of life may emerge.

163 pages. \$2.04. Mic 56-339

A TAXONOMIC STUDY OF THE MESOPHILIC ACHROMOBACTER

(Publication No. 15,083)

John Millard Rush, Ph.D.
Purdue University, 1947

Supervisor: S. E. Hartsell

The genus Achromobacter was originally described in the first edition of Bergey's Manual of Determinative Bacteriology which was published in 1923. Since then over 100 species have been described and assigned to this genus. However, the group has remained a heterogeneous collection of poorly defined species and no previous attempt has been made to isolate and study the group as a whole.

A review of the literature reveals numerous investigations of the microflora of a wide variety of sources in which

organisms belonging to the genus Achromobacter have been isolated. This widespread nature of the organisms which investigators are inclined to place in the genus suggests the need for a thorough study of the group.

In this investigation an effort has been made to bring together as many of the known or tentatively identified Achromobacter as possible from stock and private collections. In addition an attempt has been made to isolate, from representative sources, as many of the species as possible which have been described as belonging to this genus. As a result of these efforts a collection of over 400 isolations was obtained.

These cultures have been studied as to their cultural characteristics on gelatin, agar, potato, and nutrient broth media. These studies reveal characteristics which may be summarized briefly as: they usually produce circular colonies which are non-chromogenic on agar and gelatin. On potato slants the growth may be either light gray, light tan, or colorless. Broth cultures show turbidity throughout, with light pellicle formation in some cultures and viscid sediment. Growth is usually moderate to rapid.

Morphologically these organisms are gram negative non-sporeforming rods occurring as singles and pairs. Chain formation is observed in some species. Capsules are not formed and irregular staining is not observed. Both motile and non-motile forms occur. When motile, the arrangement of the flagella is peritrichous.

Physiologically, the group as a whole is relatively inactive with respect to most of the biochemical tests used for the identification of other common bacteria. The majority of the species ferment only glucose and then only with the production of acid. Gas production from carbohydrates was observed only in the case of one species. On the other hand 66 per cent showed positive evidence of ammonia production. Certain physiological differences among strains have been revealed which warrant their exclusion from other genera of similar morphological and cultural characteristics; these are failure to reduce trimethylamine oxide, produce urease, and their non-pathogenicity for plant and animal tissues.

Serological studies have been carried out with antisera prepared for a number of the species. All but one species (A. thalassius) produced antisera which reacted with its antigen in dilutions of 1-320 or above. Cross-reactions were not observed when each of these antisera was tested with antigens of other species of the genus. Likewise no cross-reactions were observed when agglutination tests were run, with these antisera, using as antigens the cells of other gram negative non-sporeforming rods (Erwinia, Salmonella, Eberthella, Shigella, Escherichia, Aerobacter, Proteus) belonging to the family Enterobacteriaceae, and the genus Alcaligenes.

These observations indicate that the genus Achromobacter is a valid and distinct group of organisms. They are widely distributed in nature, but the number of valid species are not as numerous as the number of species previously described as belonging to this genus would indicate. It is composed of serologically heterogeneous species which are, however, distinct from other similar morphologic and serologic groups.

The type species has been isolated although this strain reduces nitrate and is active on litmus milk whereas Bergey's Manual records Eisenberg's organism as negative with respect to these characteristics. Eisenberg's original description does not record the reactions with regard to

these characteristics and no literature is cited which confirms them. The strain isolated is positive for all characteristics listed in Eisenberg's description of *Bacillus liquefaciens* which was selected, by Dr. Bergey and the committee for the publication of the manual, as the type species for the genus *Achromobacter*.

A key has been developed for the classification of the mesophilic strains of the genus using motility, gelatin liquefaction, nitrate reduction, fermentation of glucose, and litmus milk reactions as criteria for the identification of the species retained within the genus.

A detailed description of each species presents the reactions concerning over 25 different cultural, morphological, and physiological characteristics.

91 pages. \$1.14. Mic 56-340

HETEROSIS IN CORN; AND THE ROLE OF PHOTOSYNTHESIS IN THE DEVELOPMENT OF *PUCCINIA SORGHI* SCHW.

(Publication No. 15,427)

Sayed Galal Sayed, Ph.D.
Cornell University, 1955

"Over-dominance" has been regarded by several workers to be responsible for a major part of the vigor of hybrid organisms. Cases are known where the heterozygote for a lethal or defective allele is more vigorous than either homozygotes — all types otherwise isogenic.

Here, studies were carried out to determine the effect of the cl_1 pleiotropic gene, which in the homozygous recessive results in prevention of the yellow color in corn kernels and subsequently in development of albino seedlings, on the growth of the albino seedlings and the heterozygous greens as compared with their homozygous dominant sibling seedlings. It was found that the effect of this gene in the homozygous recessive extends beyond color formation in reducing seedling vigor. This is true even when albinos are grown in darkness and compared with etiolated green sibling seedlings. However, when the heterozygote was compared with the homozygote green either in dark or light environments the latter were inferior in growth. It is postulated that the Cl_1-cl_1 locus showed an intra-allelic type of interaction which amounts to "over-dominance" or "one gene heterosis". The comparisons were determined in highly homozygous inbred stocks as well as in isogenic hybrid combinations. These findings were true whether the seedlings developed from excised embryos cultured on artificial media or from whole kernels.

Hybrid albino seedlings were found to be more vigorous than their inbred parents. The hybrid seedlings utilized a 0.3M sucrose solution — supplied via their leaf tips — more efficiently than their inbred parents.

Hybrid green corn plants were more efficient in utilizing foliar applications of a complete or phosphatic fertilizer than their inbred parents. However, the hybrid resembled the less-efficient parent in utilizing foliar applied urea as a nitrogen fertilizer.

Failure in isolating obligate parasitic fungi on artificial media had been attributed to the dependence of these fungi on "a highly labile transition product of photosynthesis" which is essential for their normal development.

The role of photosynthesis in the development of the corn rust organism was determined in this study. It was found that photosynthesis is important for the development of the rust fungus solely in that it makes available to the fungus an adequate carbohydrate supply essential for normal development of rust in the host tissues. A 0.3M sucrose solution supplied to several types of chlorophyll-deficient corn seedlings via their non-detached leaf tips compensated for lack of photosynthetic activity in these plants with respect to the normal development of the obligate parasitic fungus. In this way uniform rust infection was obtained on albino, yellow, virescent, half-green/half-albino and albino striped corn leaves.

Varying genotypes of albino seedlings exhibited different infection reactions towards different physiologic races of *Puccinia sorghi*. The fact that these seedlings were dependent on the same sucrose solution as the only carbohydrate base leads to the hypothesis that carbohydrates are not the key substances underlying physiologic specialization of corn rust races.

Increasing the carbohydrate contents in green wheat and corn seedlings which form differential series for wheat leaf rust and corn rust, respectively, did not alter the expected infection reactions when these seedlings were inoculated with their specific rust organism races. The seedlings were supplemented with sucrose introduced via their non-detached leaf tips.

Limitations of the detached leaf culture method in studies involving obligate parasitic fungi are pointed out. Several induced mechanical and physiological changes accompany leaf detachment and culture. It is suggested that in studies where this method is to be used, changes induced by the technique in the host-pathogen complexes should be recognized in interpreting results. 162 pages. \$2.03. Mic 56-341

SOME GENETIC ASPECTS OF RESISTANCE TO PARATHION IN THE TWO-SPOTTED SPIDER MITE *TETRANYCHUS TELARIUS* L.

(Publication No. 15,681)

David Livingstone Watson, Ph.D.
Cornell University, 1956

This research was designed to support the hypothesis that resistance to parathion in the two-spotted spider mite *Tetranychus telarius* L. is controlled by a multiple gene system. In addition, data were accumulated on the effects of dosage and temperature on the development of resistance, and the occurrence of cross tolerances for related and unrelated compounds for strains selected specifically for resistance to parathion.

In support of the multiple gene hypothesis a program of developing strains of *Tetranychus telarius* L. resistant to parathion under 90° F constant temperature conditions was carried through forty-five generations. Two strains were sampled at random from a wild population, (N III) and were distributed between one high, and one low, level of selective intensity. A third strain was maintained as a control. Resistance was developed by treating all stages with the aerosol method every third generation. The survivors of each selection were allowed to interbreed and rebuild the population.

Dosage-mortality data, analyzed with Finney's (1952) method of probit analysis, indicated the high selection pressure to produce resistance initially at a faster rate up to the twenty-seventh generation. As selection continued, however, at the high and low levels of selective intensities, both strains manifested an equal degree of resistance at the forty-fifth generation. These results have shown that resistant genes are accumulated initially at a faster rate under high, rather than low selective intensities. The low selective intensity over an extended program of selection, however, accumulated resistant genes to produce a strain equal in resistance to the highly selected strain.

The data accumulated following each selection demonstrated an initial high variability which gradually decreased as resistance increased. The amount of selective agent required to maintain the low and high selective intensities increased geometrically rather than arithmetically. These results indicate that genes are initially accumulated by small increments which are gradually extended in an exponential manner. Thus the effect of two or more genes for resistance together is considerably greater than would be

expected from the added values of the effects of a single gene for resistance. All evidence supports the multiple gene hypothesis.

The holding temperature of the resistant strains was lowered from 90° F to 70° F for eight generations. Dosage-mortality data indicated the resistant strains to be significantly more susceptible to parathion at the lower temperature with an increase in variability.

Cross tolerance studies showed dithio (tetraethyl dithionopyrophosphate) a material chemically related to parathion to possess a high degree of cross tolerance for strains developed specifically for parathion-resistance. The unrelated compounds chlorobenzilate (Ethyl 4:4-dichlorobenzilate), aramite (2-chloroethyl-1-methyl-2-(p-tertbutyl-phenoxy) ethyl sulfite) and FW-293 (1, 1-bis (chlorophenyl) trichloro-ethanol) demonstrated a limited amount of cross tolerance. On the basis of the LD₅₀ values the resistant strains in response to the unrelated compounds required approximately twice the dosage of the control strain.

104 pages. \$1.30. Mic 56-342

BOTANY

A NEW GENUS OF PTERIDOSPERM PRECURSORS FROM THE DEVONIAN OF NEW YORK

(Publication No. 15,512)

Charles Beverley Beck, Ph.D.
Cornell University, 1955

Chairman: Harlan P. Banks

This thesis deals primarily with the description of a new Upper Devonian genus, *Tetraxylopteris*, from the Oneonta formation in eastern New York, a discussion of its taxonomic position.

A general discussion of the geology of the Catskill Region is presented with emphasis on the Oneonta and other formations pertinent to this study.

The fossil material utilized is basically of a compression type, but some axes are structurally preserved by iron pyrite. This valuable type of preservation allows a relatively complete reconstruction of the plant. However, a study of the pyritized axes poses a difficult problem of technique. A method of studying this type of material which has been used with exceptionally good results is presented in detail. This consists, essentially, of coating the surfaces of sections of pyrite containing the plant material with Harleco Synthetic Resin dissolved in toluene. The toluene is evaporated, leaving a thin coating of HSR on the surface of the sections which fills the depressions and prevents crumbling in grinding and polishing.

Tetraxylopteris consists of a stem bearing spirally arranged branch systems called cryptophylls. The cryptophylls which are considered to be homologous with leaves are radially symmetrical. Branching of axes in the cryptophylls is opposite to sub-opposite and decussate.

Terminal axes in the sterile cryptophylls and the basal portions of fertile cryptophylls are once or twice bilobed and recurved ultimate divisions (pinnules). Some cryptophylls are fertile in their apical parts bearing large, exannulate sporangia. A fairly complete description of the anatomical structure of the cryptophyll axes is presented. The primary xylem which is in a cruciform strand, the secondary xylem and secondary phloem are described in detail. Other tissues are less well known.

Tetraxylopteris is considered to be most closely related to *Aneurophyton* and *Eospermatopteris*. This group of three genera seems to be intermediate between the psilophytes and pteridosperms. *Aneurophyton* and *Eospermatopteris* have been taken out of the Protopteridiales, an order containing forms intermediate between the psilophytes and ferns, and included in a new order, *Aneurophytales*, erected for them. This order is placed in the class *Cycadophyta* of the subdivision *Pteropsida*, division *Tracheophyta*. It is the most primitive order in the class and accordingly precedes *Pteridospermales* in the hierarchy.

The telome theory is reviewed and the significance of the cryptophylls of *Tetraxylopteris* is discussed in the light of this theory. It is pointed out that the description of the phloem of *Tetraxylopteris* is the second report of extensively preserved secondary phloem in a Devonian plant, the first being in *Callixylon*. A short discussion of phloem in Paleozoic plants is given. The importance of utilizing information from both compressions and associated pyritized axes when present is emphasized.

115 pages. \$1.44. Mic 56-343

THE SAVANNA VEGETATION OF WISCONSIN AND
AN APPLICATION OF THE CONCEPTS ORDER AND
COMPLEXITY TO THE FIELD OF ECOLOGY

(Publication No. 14,760)

John Roger Bray, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor John T. Curtis

The savanna vegetation of Wisconsin, embracing all grasslands in which there are scattered open grown trees, has been studied with a sampling of 59 tree stands and 84 herb and shrub stands containing 1,760 one-by-one meter quadrats. Tree stands were sampled by the random pairs method and herb stands by quadrats laid at random within the stands or contiguously along transects which extend from prairie through savanna and into forest. Some herb data was gathered from transects projected from beneath the canopies of isolated trees into prairie.

Soil samples of the A₁ layer were collected and 4,000 light readings were made, 946 of which were taken over sampled herb quadrats.

Although most tree stands were strongly dominated by one species, a compositional gradient was constructed which showed, for the tree species, a series of intergrading normal frequency distributions. Major species along this gradient in order of dominance were: *Juniperus virginiana**, *Betula papyrifera*, *Quercus velutina**, *Quercus alba**, *Carya ovata*, *Quercus macrocarpa**, *Quercus rubra*, *Quercus bicolor**, *Fraxinus pennsylvanica*, *Ulmus americana** and *Acer saccharinum*. The species marked with an asterisk made up 90 percent of the total Importance Value in savanna.

Four major historic origins of savanna were outlined; (1) The complete destruction by fire of climax forest or intermediate moistland forest (neither of which contain fire resistant species capable of grub formation) and an invasion of prairie with a subsequent or concomitant entrance of *Quercus macrocarpa* or *Quercus bicolor*, this entrance helped by ability to form grubs. (2) The degradation by fire of intermediate dryland forest to brushland containing the grubs or stump sprouts of *Quercus alba*, *Quercus velutina*, *Quercus ellipsoidalis*, *Carya ovata*, and to a lesser extent *Quercus rubra*. Within this brushland occasional trees were able to reach adult size. (3) The invasion of dry prairie by *Quercus macrocarpa*. (4) The entrance, after the cessation of fire and usually under the stimulus of grazing, of *Juniperus virginiana* and *Betula papyrifera* into dry prairie, and of *Ulmus americana* and *Fraxinus pennsylvanica* into moist prairie.

Hybridization was noted between *Quercus macrocarpa* and *Quercus bicolor* and introgression was demonstrated as taking place from the hybrid to the parent, *Quercus bicolor*.

Three hundred species of herbs and shrubs were found in savanna, all of which had been previously recorded from prairies or upland forests in Wisconsin.

Spatial gradients showing transition as it exists in the field between prairie and forest were constructed for 44 herb stands in seven geographic locations.

A two-dimensional theoretic gradient was made by assigning 92 herb stands (including some pioneer forests) positions along axes determined by previously established prairie and upland forest continua.

Within the theoretic gradient, a linear trend was noted from stands with species characteristic of high light intensities and low soil and air moistures, to stands with species of lower light intensities and higher soil and air moistures. Intermediate areas showed a spindle-shaped widening in which stands with high light intensity compensated by high soil moisture were found along with stands in which a lower soil moisture was moderated by lower light intensities.

Both the spatial gradients and the theoretic gradient showed herb species frequency distributions which gave a continuum pattern and showed an even interchange in species dominance from prairie to forest.

A decrease in fertility per unit volume of A₁ was shown for Ca, Mg, P, K, and NH₂, along the herb gradient from prairie to pioneer forest. This decrease, which reached its maximum amount in pioneer oak forests was shown to be reversed and original levels of fertility were regained as development proceeded to the maple-basswood forest.

Light measurements showed species to have, within a range of uniform soil moisture, definite light intensity amplitudes. Many species of moist prairie were found under the canopies of trees in savannas with a relatively low soil moisture.

A general theory which is adequate to explain scientific phenomena on any level, physical, biologic or social, is believed by Engelmann to be based on a delineation of a phenomenon, either as an emergent at the intersection of its constituent elements or as a differentiation from a field.

The theory of emergent configurations has appeared in ecology in the concepts of Holism and hierarchical levels of organization and in the concept of succession.

The theory of field determination has not been often expressed because of a mechanist concentration on causality and the sampling of single factor environmental gradients with a consequent neglect of community structure analysis. A possible future ecologic development of field theory appears to be in the analysis of matrices of Quantitative Coefficients of Community from which a fluid structure for the placement of stands or species can be determined.

Since the logical development of emergent and field theory for biology (though promised by Bertalanffy) is as yet incomplete, two recent concepts, order (the number of distinguishable particles and the number of positions which any particle is free to occupy) and complexity (the number of parameters needed to fully describe a system) were applied to the field of ecology.

The development of a community in terms of entropy change and the attainment of a steady state was described. A separation of a community from an individual organism (with which a community has been held analogous) on the basis of energy dynamics was attempted.

A technique for analyzing complexity on the basis of the sum of the ordered (i.e., normal) differences among parts was outlined. The technique was applied to eight ordinations of a set of herb data. Phytosociologic arrangements which were based upon a previously constructed continuum and on a modified factor analysis showed a higher complexity than arrangements based upon environmental measurements which in turn were more complex than random ordinations.

291 pages. \$3.64. Mic 56-344

STUDIES ON SEROLOGY OF CUCURBIT AND BEAN VIRUSES

(Publication No. 14,703)

Dennis Heeley Hall, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor John Charles Walker

The production of antiserum in rabbits with preparations of bean and cucurbit viruses administered by 3 injection routes was successful only with bean virus 4 and with 4 viruses representative of the squash mosaic group. The latter group of viruses consists of several strains all of which are serologically related with the exception of wild cucumber mosaic virus. The latter was shown to be, by reciprocal precipitin tests, a serologically distinct virus entity.

Three melon mosaic viruses and common cucumber mosaic virus failed to form a precipitate in the presence of antiserum prepared against a typical squash mosaic virus and the wild cucumber mosaic virus. This indicates that the melon viruses and cucumber mosaic virus are not related to the latter two viruses. Since attempts to produce antisera against a typical melon virus and common cucumber mosaic virus were not successful, positive statements regarding their relationships cannot be made without qualification. However, the probability that these viruses are related to those of the squash mosaic group is remote because of the negative precipitin results and because of the differences in physical properties and insect transmission studies made by previous workers.

The precipitin tests made with bean virus 1 and bean virus 2 with their homologous antisera were seriously hampered by the occurrence of non-specific precipitates when concentrated virus preparations or partially cleared crude sap was used as the source of antigen. The spontaneous precipitate was eliminated by clarification of bean sap by chloroform extraction, acid fractionated or by dialysis and subsequent dilution. Based on the results obtained, the precipitin tests are not reliable unless proper steps are taken to eliminate the cause of the non-specific precipitation.

It is significant to note that antibodies specific against the antigen injected were formed only with those viruses considered relatively stable with respect to their physical properties. The fact that common cucumber mosaic virus, bean virus 1, and bean virus 2 in relatively high concentrations free from much of the normal plant constituents apparently did not stimulate the formation of antibodies when injected into rabbits casts doubt upon the validity of previous reports made of successful production of antibodies with these viruses when injected into animals in the form of crude sap. The possibility of stable virus contaminants being present and remaining undetected in preparations used for serological studies could conceivably be one explanation for success on the part of others in preparing antiserum against these viruses.

It is unlikely that antiserum can be produced specific against the less stable viruses by the standard methods employed in this investigation. Success will probably be dependent upon an entirely different approach to serological investigations with these viruses.

58 pages. \$1.00. Mic 56-345

STUDIES ON A BACTERIOPHAGE OF *XANTHOMONAS PRUNI* (E. F. SMITH) DOWSON

(Publication No. 15,220)

Donald Dale Hickman, Ph.D.
University of Illinois, 1955

The number of plaques produced by this phage is proportional to the phage dilution used in the preparation of plaque plates. Studies of factors influencing plaque formation revealed that plaque plates prepared with a base layer of 15 ml of 2% nutrient agar, a surface layer of 2 ml of 0.6% nutrient agar, an initial bacterial concentration of 2 to 4 X 10⁷ active cells per ml, and incubated at 27° C, provided optimum conditions for plaque formation by this phage isolate. The number and size of plaques was reduced by increasing quantities of nutrient agar in the base layer, by increasing quantities and agar concentrations in the surface layer, and by increasing bacterial concentrations. Plaques were not formed in plates incubated at temperature intervals below 24.2° C or above 29.7° C.

There was no reduction in phage titer after two hours in nutrient broth from pH 5.0 through pH 10.0, in 2% ammonium acetate from pH 5.0 through pH 9.0, and in 1% ammonium benzoate at pH 7.5. Solutions of 100, 200, and 300 grams per liter sucrose, and 50% glycerol produced significant reductions in phage titers. The phage can be concentrated by ultra-centrifugation. Density-gradient centrifugation in sucrose solutions reduced the titer of phage concentrates, probably by separating the phage heads and tails. Filtration through Seitz and Berkefeld filters at pH 7.5 and 8.0 reduced phage titers by 20% to 50%, as compared with unfiltered lysates. Filtration through Celite from pH 3.5 through pH 7.5 produced no reduction in phage titer.

Normal and phage-infected bacteria were prepared for electron microscopy by air-drying washed whole bacteria, by partitioning, and by sectioning. In both air-dried and sectioned preparations the phages were observed attached to the host by the tips of their tails. The phage head is hexagonal in outline, and sectioned preparations indicate that it consists of an outer halo of about 10 millimicrons surrounding an inner area of greater density. The phage head diameter is about 65 millimicrons, and the tail measures about 85 X 20 millimicrons. Over sixty different methods of fixation, dehydration and embedding were employed in processing the bacteria for sectioning. The results showed that the final structures observed in sectioned bacteria depend not only upon the method of fixation, but also upon the wash following fixation, the method of dehydration, and the method of embedding the cells in methacrylate. Sectioned normal bacteria had a cell wall about 100 A thick. The cytoplasm within the cells consisted of fibrils about 50 to 100 A in diameter interwoven to form a dense, finely textured mesh. Each cell contained one or more vacuoles which were less dense than the cytoplasm and which varied in number, size, and shape from cell to cell. It was shown that these vacuoles are comparable to the areas of the cell which are deeply stained by the HCl-Giemsa method used in light microscopy to reveal bacterial "nuclei". The centers of the vacuoles were occupied by dense areas whose basic structure was highly dependent upon the methods used in processing the cells for sectioning. In phage-infected cells the cytoplasm moved to peripheral regions of the cell, while the vacuoles enlarged and developed a coarser texture. Structurally differentiated bodies appeared within the

cell. These bodies often consisted of one to four subunits and may represent an exponential phase in phage reproduction. The individual subunits are believed to gradually enlarge and become more dense, finally forming the mature phage heads. A dense, porous body, varying from 45 to 250 millimicrons in diameter, was observed within whole, partitioned, and sectioned phage-infected cells, but was not found in normal cells. 123 pages. \$1.54. Mic 56-346

PREVENTION OF THE INHIBITORY EFFECTS
OF IMIDAZOLE, BENZIMIDAZOLE, AND
HISTAMINE ON MITOSIS AND ROOT ELONGATION
IN VICIA FABA ROOTS

(Publication No. 14,723)

Donald James McCorquodale, Ph.D.
The University of Wisconsin, 1955

Supervisor: Robert E. Duncan

A comparison of the action of certain imidazole compounds was conducted with the hope of elucidating the manner in which they were acting. If the mechanisms of action could be determined, some of the physiological processes underlying cell division and elongation might be revealed.

The assays, using the frequency of mitotic stages as a measure of relative mitotic activity and root length increase as an indication of the rate of cell elongation, were done using Vicia faba primary roots obtained from 4 to 5 day-old seedlings. After selection for uniform size, excision of plumules, and placement of an India-ink reference mark for use in root elongation measurements, eight roots were allotted to each treatment solution. While the cotyledons rested on top, the roots protruded through holes in plastic lids and were immersed in aerated distilled water as a control or aqueous solutions (pH 6.0) of the chemicals under investigation in 800 ml. beakers. Rate of root elongation was determined by measuring the root length between tip and mark at predetermined time intervals when also, four roots were fixed in 3:1 alcohol:acetic for subsequent Feulgen staining. Mitotic frequency was estimated in microscope-slide transects of free cell suspensions by averaging the tally, as to mitotic stage, of 1000-cell samples from each of four roots. The suspensions were the result of macerating 2 mm. of each root tip in 5% pectinase for 6 hours followed by resuspending in phosphate buffered Karo syrup (pH 7.0).

Imidazole (4.4×10^{-3} M), benzimidazole (2.5×10^{-3} M), and histamine (1.25×10^{-3} M) respectively caused a 65, 80, and 90% inhibition of root elongation and a 75, 95, and 100% depression of mitotic activity at 48 hours. All three compounds induced formation of a black pigment in the regions of the root above the meristem. Roots treated with 4.4×10^{-3} M imidazole or 1.25×10^{-3} M histamine in the presence of complete nutrient solution showed no inhibition of root elongation or cell division and no formation of any kind of pigment. Roots treated with 2.5×10^{-3} M benzimidazole in the presence of complete nutrient solution showed no inhibition of mitosis and no pigment formation while root elongation inhibition was only 60% of that obtained with benzimidazole alone.

Ca^{++} or Mn^{++} ions alone prevented the imidazole effect while Zn^{++} , although having no effect on root elongation or pigment formation, prevented the mitotic inhibition. Mn^{++} alone was found to prevent the benzimidazole effect, although Ca^{++} appeared to have some activity in relieving the mitotic depression. The histamine effect could be prevented only with Ca^{++} .

Treatment of roots with 2.5×10^{-3} M 4-amino-5-imidazolecarboxamide produced effects similar to the above compounds. Treatment with 2.5×10^{-3} M histidine showed no inhibitory effects at 24 hours.

Cytological investigation revealed an occasional granulated nucleolus in imidazole treated tissues, while nucleoli in benzimidazole and histamine treated tissues were distinctly swollen and nuclei poorly stained. Since there was no change in the relative frequency of mitotic stages, no one mitotic stage was differentially affected.

Although these imidazole compounds are known to chelate various metal ions, no evidence was obtained that they were complexing the metals which prevented their effects.

It is concluded that the compounds show similarities in mode of action. This cannot be entirely true, however, since they require different ions to prevent each of their effects. Zinc apparently plays a special role in mitosis while calcium and manganese are critically involved in both cell division and elongation. The significance of the pigment formation remains obscure, but perhaps it indicates resorting to alternate pathways of respiration when there is interference with ions involved in normal respiration. The results also indicate that benzimidazole and imidazole are not strict antimetabolites as previously suggested.

102 pages. \$1.28. Mic 56-347

THE ANALYSIS OF A COMPOUND LOCUS IN MAIZE
AS REVEALED BY GENIC INSTABILITY

(Publication No. 15,256)

Dewayne Leroy Richardson, Ph.D.
University of Illinois, 1955

The compound A_1 locus in maize was analyzed for its component parts and their linear arrangement by an analysis of an array of mutants produced in response to a mutator system. The pale mutable (a^{Pm}) stock from which most of the mutants were obtained has an aleurone with a pale purple background on which are found sectors of colorless and deep purple tissue. It produces a dominant brown pericarp color and is genetically unstable. The mutants have been characterized for aleurone and pericarp color as well as for instability.

Mutants of a true breeding type (constant mutants) have been isolated from a^{Pm} stocks as well as a class of mutants with erratic breeding behavior (aberrant mutants). The 87 constant mutants studied fall into four general classes: (1) pale self — with pale aleurone, dominant brown pericarp, and a lack of mosaicism, (2) deep self — with deep aleurone red pericarp, and little mosaicism, (3) colorless-a — with colorless aleurone, dominant brown pericarp, and no mosaicism and (4) colorless-b — with colorless aleurone, recessive brown pericarp, and no mosaicism. These characteristics of the mutants are believed to be controlled by the activity or failure of activity of the components of the a^{Pm} locus.

These components are: α , a pale pigment producing component, β , a deep pigment producing component, M , a factor controlling mutability, and Pb , the component for dominant brown pericarp color.

Some indication of the arrangement of the components at the A_1 locus can be gained from an analysis of the different types of mutations produced by the a^{Pm} stock. The assumptions made in this analysis are: (1) the components of the locus are arranged in a linear order, (2) the loss of the activity of components is controlled by the inhibitory characteristics of the mutator, M , (3) inhibitory activity originating from M can proceed along the chromosome both proximally and distally, and (4) when M inhibits a component, all intermediate components are also inhibited. By applying these assumptions to the mutant types, three arrangements of the components are possible. These are: (1) Centromere - Pb - M - α - β , (2) Centromere - Pb - M - β - α , and (3) Centromere - β - M - α - Pb .

Two possible cases of spreading effect are included among the mutants from a^{Pm} . A change in the mutator M at the a^P locus apparently affected closely linked genes controlling chlorophyll production and viability.

Evidence pointing to the possible separateness of the aleurone and plant color characteristics is cited.

90 pages. \$1.13. Mic 56-348

A STUDY OF PLANT GROWTH INHIBITION AND METAL COMPLEX FORMATION BY STREPTOMYCIN

(Publication No. 14,730)

Walter George Rosen, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Folke Skoog

Studies have been conducted on the inhibition by streptomycin of growth and chlorophyll formation in higher plants.

Avena coleoptile sections were employed for most of the quantitative studies of growth inhibition. Treatments with streptomycin (100 mg/l; 1.7×10^{-4} M) inhibited growth of the sections by approximately 80 per cent when added to a medium consisting of 2 per cent sucrose and 1 mg/l of IAA. The inhibition was prevented by the addition of manganous salts, and to a lesser extent, by calcium salts. The inhibition caused by 100 mg/l of streptomycin was completely prevented by 1×10^{-3} M $MnCl_2$. Several other inorganic salts, and various sugars, organic acids, and amino acids, did not prevent the inhibition by streptomycin. $MnCl_2$ and $CaCl_2$ also prevented inhibition by streptomycin of growth and dry weight increase of sections of stem internodes of *Pisum*.

Respiration of *Avena* coleoptile sections was inhibited by treatments with streptomycin. In the presence of added $MnCl_2$ this inhibition was reduced.

Streptomycin, applied to bean and radish seedlings, and to leaf discs cut from etiolated bean seedlings, inhibited growth, leaf expansion, and chlorophyll formation or accumulation. The growth inhibition effects of streptomycin in these plants were partly prevented by $MnCl_2$. Protection by $MnCl_2$ against the chlorosis caused by streptomycin was slight or absent in different experiments.

Complex formation between streptomycin and inorganic cations in aqueous solution was indicated by: a) shifts in the potentiometric titration curve of streptomycin when salts of Ca^{++} , Cu^{++} , Mg^{++} , or Mn^{++} were present, b) shift in the half-wave potential of Mn^{++} from -1.52 to -1.55 volts when streptomycin was present, and c) increased solubility of streptomycin in acetone when Cu^{++} , Mg^{++} , or Mn^{++} were present.

It is proposed that streptomycin inhibits the growth of plants by combining with, and thereby inactivating, essential cations within the cells, and that inhibition of the growth of *Avena* coleoptile sections probably results specifically from combination of streptomycin with Mn^{++} although inhibition by combination with other cations is not excluded. Prevention of streptomycin inhibition by the addition of Mn^{++} or Ca^{++} is proposed to result from their combination with streptomycin, thus maintaining the critical supply of Mn^{++} or other cations within the cells.

In a model system $CaCl_2$ reduced the inhibition of growth of *Avena* coleoptile sections caused by ethylene diamine tetraacetic acid, a compound which combines with cations. $MnCl_2$ did not prevent growth inhibition by this particular compound.

The hypothesis of complex formation with essential cations is compatible with the diversity of reported effects of streptomycin on growth and metabolism, and with various accounts of the activity of streptomycin under different experimental conditions. 135 pages. \$1.69. Mic 56-349

DEVELOPMENT OF THE ASCOCARP OF ANTHRACOBIA MELALOMA

(Publication No. 15,530)

Martin Albin Rosinski, Ph.D.
Cornell University, 1955

Anthracobia melaloma is a small Operculate Discomycete which is found most frequently on burnt wood. It grows and fruits readily in pure culture. The species is heterothallic.

Archicarps are produced by both mating types when these are grown separately. Antheridia cannot be distinguished except when they are in contact with a trichogyne.

Plasmogamy is effected by the coiling of the tip of the trichogyne around an antheridial hypha. One cell of the antheridial hypha, the one in contact with the very tip of the trichogyne, swells until it is almost spherical. The walls between this swollen cell (the antheridium) and the trichogyne break down permitting the interchange of nuclei and cytoplasm.

The ascogonium can be separated into 3 distinct regions just prior to the formation of ascogenous hyphae. The ascogonial cells have very large pores in the cross walls. The cells of the trichogyne can be distinguished by the amorphous structure of the protoplasm, and the swellings in the cross walls of the 6 to 8 cells nearest to the ascogonium. The stalk cells are distinguished best by the broad hyphae branching from them.

Ascogenous hyphae develop from 2, 3, or 4 ascogonial cells. These rapidly spread throughout the young apothecium and become septate. Branches arise from the cells of these primary ascogenous hyphae and two nuclei migrate out into these branches. The lateral branches immediately

bend over forming characteristic croziers, and conjugate division of the two nuclei in these laterals presumably occurs. Asci do not form immediately after the first croziers are developed. Instead, the nuclei in the penultimate cell usually divide conjugately again. This process of conjugate division in the penultimate cell may occur many times before an ascus is finally formed.

The hyphae giving rise to the sterile portion of the apothecium develop from the stalk cells of the archicarp. These are broad hyphae which contain a darkly stained protoplasm and nuclei of the same size as the nuclei in the ascogonial and stalk cells.

The formation of the cortex and paraphyses is the result of sympodial growth of the sheath hyphae as described by Corner (1939). The hairs are merely terminal cortical cells which differentiate further by elongation and by darkening and further thickening of the walls.

54 pages. \$1.00. Mic 56-350

A STUDY OF ENTOMOSPORIUM ON CRATAEGUS

(Publication No. 14,743)

Ewell Addison Stowell, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Myron P. Backus

The work reported here has involved a comprehensive study of a fungus inciting leaf-blight of hawthorn. Investigations have been conducted to determine the true identity of this pathogen, to reveal the relation of the pathogen to the host, and to determine the microscopic structure of the fungus in the various phases of its development.

Naturally-infected leaves of Crataegus oxyacantha L. and of an unidentified native species of hawthorn growing in southern Wisconsin provided most of the material for life history studies and for the investigation of host-parasite relations. Apothecia matured in leaves of C. oxyacantha which had been overwintered in wire cages. For the study of many structural details, free-hand sections and dissections of fresh material were found to be advantageous supplements to the microtome sections prepared from fixed specimens embedded in paraffin.

The mycelium of the Crataegus leaf spot fungus is composed of uninucleate cells. In the living host tissues the hyphae of the pathogen occupy an intercellular position, but haustoria penetrate cells of the mesophyll, epidermis, and bundle sheath. Haustoria have not previously been reported for any species of Entomosporium.

The cruciform macroconidia are formed in subcuticular acervuli which are largely epiphyllous. These spores were found to be capable of immediate germination. Later in the season microconidiophores and microconidia are developed, some appearing in the macroconidial pustules but the majority occurring in special microconidial acervuli formed beneath the cuticle of the lower leaf epidermis. All attempts to germinate the microconidia failed.

The formation of stromatic cushions in the spongy mesophyll at the same time that microconidia develop marks the initiation of the perfect stage of the fungus. Within the prosenchymatic stromata coiled archicarps appear; these are prolonged into slender trichogynes the

tips of which commonly protrude through the leaf stomata. In free-hand sections microconidia were found firmly attached to the trichogynes. This suggests that the microconidia may function as spermatia.

A new growth of saprophytic mycelium appears at the time of leaf-fall and is associated with the further development of the ascocarp initials.

Apothecia mature in May and June in Wisconsin. The asci develop through crozier formation and at maturity contain eight hyaline two-celled ascospores. An amyloid ring can be demonstrated at the ascus apex. Filiform paraphyses are present. Frequently, however, the potential ascocarps fail to produce spore sacs. Instead, apothecial conidia, which mimic the macroconidia of the parasitic Entomosporium stage, may be formed in the fructifications. Present evidence indicates that these conidia may be important in establishing new infections at the beginning of the growing season.

Single-spore cultures obtained from discharged ascospores were indistinguishable from cultures obtained from macroconidia produced in acervuli on living leaves. In all cases there was limited mycelial development, and production of Entomosporium-type macroconidia was observed.

The Entomosporium commonly occurring on Crataegus in North America appears to be specifically distinct from members of this genus found on Pyrus, Cydonia, and other hosts. It is concluded that E. thuemenii (Cooke) Sacc. is the correct binomial to apply to this fungus in its imperfect stage. For the perfect stage, a new species, viz., Fabraea thuemenii sp. nov., is erected.

244 pages. \$3.05. Mic 56-351

A PHYTOSOCIOLOGICAL STUDY OF LOWLAND HARDWOOD FORESTS IN SOUTHERN WISCONSIN

(Publication No. 14,785)

George Henry Ware, Ph.D.
The University of Wisconsin, 1955

The composition, range of variation, and ecological relationships of the lowland hardwood forests of southern Wisconsin were studied by means of quantitative information obtained by the sampling of 114 stands widely distributed over the southern half of the state. The study was restricted to forests of natural origin which displayed no indications of past disturbances such as fire, cutting, and grazing.

The use of the random pairs sampling method of ecologists provided data from which relative frequency, relative density, and relative dominance were obtained for each tree species in every stand. The summation of the three values yielded what is known as an importance value, which was used as a quantitative basis for comparison of species behavior.

By representing the importance values in diagrammatic form by bars, an ecologically syntactical scheme was worked out which indicated that a relative ecological arrangement of the 12 most common species was as follows: Salix nigra, Populus deltoides, Betula nigra, Quercus bicolor, Acer saccharinum, Fraxinus pennsylvanica var. subintegerrima, Ulmus americana, Fraxinus nigra, Tilia americana, Quercus rubra, Celtis occidentalis, and Acer saccharum.

Adaptation numbers from 1 to 10 were assigned to species on the basis of their relative position indicated by the bar diagrams. *Salix nigra* was given the number 1, and *Acer saccharum* was given the number 10. By using both the importance values of the species of a stand and adaptation numbers of the same species; by obtaining the product of the two values for each species; and by summing the products for all species of a stand, a differentially weighted cumulation value for each stand was obtained. Stand values were used for the collocation of all 114 stands of the study along a compositional gradient.

Smooth and regular curves, representing the behavior of saplings, herbs, and soil properties along the compositional gradient, were found and submitted as corroborative attestation to the proper arrangement of tree species on the compositional gradient. Certain adjunctive forest properties, including water-holding-capacity of the soil, basal area per acre, available calcium, and available nitrate nitrogen, suggested that differences exist between swamps of fluvial origin and swamps of lacustrine origin which are of sufficient importance to warrant separate study of the two swamp groups.

Successional implications are nowise intended by the diagrammatic arrangement of tree species nor by the assignment of adaptation numbers to the tree species. There is little that the vegetation can do to make the environment of a swamp suitable for mesic species. The replacement of swamp species by more mesic species must await physiographic changes such as accretion and river deepening.

The expression of an ecologically syntactical scheme for lowland hardwood tree species on a linear compositional gradient is a convenient method of viewing what is well-known to be a two dimensional problem. The compressing of a number of planes into one plane is comparable to viewing an elongate range of mountains from a great distance in that the peaks blend together in what appears to be a single plane.

The vicissitudinous nature of swamps and floodplains seem to be related to great genetic and ecologic variability among lowland species. Knotty taxonomic and ecologic problems in the study of red, green, and white ash; red and silver maple; swamp white oak; and American elm are especially apparent in the lowland hardwood forests of southern Wisconsin.

280 pages. \$3.50. Mic 56-352

CHEMISTRY

CHEMISTRY, GENERAL

X-RAY DIFFRACTION AND ELECTRON MICROSCOPIC OBSERVATIONS ON STAGES OF ORGANIZATION BETWEEN CRYSTALLINE AND AMORPHOUS STATES

(Publication No. 15,180)

George William Bailey, Ph.D.
University of Illinois, 1955

There are still many unanswered questions concerning the unique structures and textures of carbon in the form of graphites, graphitic carbons, and carbon blacks in almost infinite variety for a multitude of practical uses. This investigation was designed to answer many of these problems by the use of improved research techniques.

1. Numerous varieties of graphite and carbon black samples have been thoroughly investigated by x-ray diffraction and electron microscopy techniques. Because of the nature of the material which was studied, it became necessary to improve on certain x-ray methods and to introduce a completely new sectioning method for the preparation of ultrathin sections for electron microscopy examination, a method never before applied to graphite or carbon black.

2. Three different groups of graphites, two artificially produced and one naturally occurring, and one group of carbon blacks were examined. Each group of graphites was a series of samples which had been ground in a ball mill for varying lengths of time, up to a maximum grinding time of 144 hours. X-ray diffraction patterns of each member of each series were made using the General Electric XRD-3 X-Ray Diffraction Unit. The stability, reproducibility, and exclusive use of this instrument has permitted a very accurate and comprehensive study of the graphite samples as well as the carbon black materials.

3. From the x-ray diffraction patterns of the graphite samples it was possible to calculate the primary crystallite dimensions, L_a and L_c , as well as the unit cell dimensions, a and c . Thus there appeared a trend toward disorder such as is found in carbon blacks. In addition to the disorganization that occurred on grinding, the particle size decreased regularly throughout each series, as would be expected from the mechanical working, into the colloidal particle range. This was evidenced by a comparison of the calculated L_a and L_c values derived from measurements of line broadening.

4. A deterioration of the structure of the graphite as well as a reduction of crystallite size is proved by changes in the unit cell c dimension which is the interplanar spacing for the basal planes. During the grinding process this parameter increased toward a value typical of carbon blacks, which indicates a trend toward disruption of three-dimensional crystalline order though a complete transformation is never realized.

5. Seven different series of heat treated carbon blacks were investigated for the purpose of discovering whether

identical materials could be produced by the mechanical degradation of crystalline graphite (decreasing order) and the annealing of carbon black (increasing order). A gradual increase of peak heights and a slight sharpening of the interferences were observed with each black as the temperature was increased. A very limited degree of graphitization was found to occur in the temperature range studied: 1100 to 1400° C. Definite decreases in the unit cell c dimension as well as regular increases in primary crystallite size were observed, indicating that both organization and growth were occurring in the material during heat treatment.

6. As a result of these studies the contention by Franklin that only two values of c are possible, respectively, for graphite (minimum) and for carbon black (maximum), is disproved with evidence of a continuous range of values between the limits.

7. A rapid quantitative x-ray method for determining the percent graphite present in any partially graphitized carbon black or synthetic mixture of graphite and carbon black was developed.

8. All the graphite samples which were examined by x-ray diffraction and some of the carbon black samples were investigated by a new electron microscopy technique. Each sample was dispersed in n-butyl methacrylate monomer which was polymerized by ultraviolet light. The dispersed graphite, or carbon black, was sectioned with the Sjostrand Ultramicrotome down to approximately 200 Å. in thickness. Samples prepared in this manner yielded a better dispersion and more efficient deaggregation than ever before achieved by any technique. The sections were then viewed and photographed with the RCA EMU-2E Electron Microscope. The results on changes in particle size were in good agreement with the observations made by x-ray diffraction. However, one striking irregularity was observed with the graphites undergoing prolonged grinding. The particles appeared to reaggregate and remain in relatively large clusters, though the individual particles continued to decrease in size as evidenced by a careful examination of the fine structure.

99 pages.. \$1.24. Mic 56-353

CHEMISTRY, ANALYTICAL

A FUNDAMENTAL STUDY OF ANALYTICAL FLAME PHOTOMETRY

(Publication No. 13,685)

William Alan Dippel, Ph.D.
Princeton University, 1954

A general survey of the subject of analytical flame spectroscopy has been presented, and a critical discussion

of some of the published work in this field in the light of the author's own experience is included.

A detailed analysis of the factors which affect the emission intensity in the Lundegardh flame has been attempted with the dual purpose of contributing to our understanding of the fundamental processes occurring in the flame and elucidating the mechanisms of the so-called "flame photometric interferences." The overall emission process has been considered in terms of four individual steps which are involved. These are (1) the transport process by which the solution is introduced to the flame, (2) the processes of dispersion and desolvation which convert a solid stream of solution into dry salt particles, (3) the dissociation process which produces free metal atoms in the flame, (4) the terminal processes of excitation and radiation by which the energy of the flame is converted to the light quanta which are observed.

It has been shown, in agreement with other workers in this field, that the solvent plays a complex, multifold role in the emission process. Because of this, the effects of the solvent on the emission intensity cannot be predicted with great accuracy. However, when dealing with mixed aqueous-organic solvents, it has been demonstrated that the emission intensity is roughly proportional to the heat liberated per unit time within the flame by the organic substance.

The principal physical properties of the organic solvent which control the temperature of the flame and the emission intensity are its heat of combustion and its viscosity. The effects of an organic substance on the processes of dispersion and desolvation are probably of minor importance in determining the emission intensity.

An extensive study has been made of the interfering effects produced by extraneous substances present in solution with the emitting substance. As expected, it was found that most organic substances studied had an enhancing effect, although substances which increase the solution viscosity very greatly are inhibitors.

No generalization can be advanced about the direction of cationic interferences. The interference effects produced by extraneous cations are probably caused by energy exchange between excited states, and both inhibition and enhancement have been observed, depending upon the flame temperature and other experimental factors.

Anionic interferences are most generally inhibitory, although several notable cases of enhancement have been observed. Among these, the most pronounced enhancement was shown to occur when perchlorate was added to solutions containing an alkaline earth metal whose emission was being measured. Inhibition by anions has been attributed to their tendency to combine with metal atoms in the flame, thus reducing the concentration of potential emitters. This effect is most pronounced for sulfate and phosphate which were observed to drastically reduce the emission intensities of all of the divalent ions studied.

This very strong reduction in the intensity of the calcium flame has been used as the basis of an analytical procedure for the determination of phosphate. By this procedure, between 0.0036 and 0.085 g. of phosphorus pentoxide present in a phosphate rock was determined with an average error of 0.15 per cent.

Means of minimizing and eliminating interferences encountered in routine flame photometric analyses of minerals and alloys have been discussed. Several dilution

procedures and a standard addition procedure were successful in reducing most of the interferences occurring in rather complex situations. However, in spite of these procedures designed to reduce such interferences, large errors continued to persist in the analysis of magnesium and calcium present in certain minerals.

The average deviation for 24 determinations performed in duplicate was 1.06 per cent. The average relative error for all N.B.S. samples, excluding the magnesium analyses, was 5.34 per cent when the element being determined was present in quantities varying between 0.1 and 70 per cent. This is superior to the accuracy attainable by most other spectrochemical methods. Because this method can be applied with a minimum of time consuming chemical treatment of the sample, most of these analyses require less than two hours of the analyst's time.

167 pages. \$2.09. Mic 56-354

I. AUTOMATIC DIFFERENTIAL POTENTIOMETRIC TITRATIONS.

II. THE DETERMINATION OF CHLORIDE IN TITANIUM SPONGE.

(Publication No. 15,203)

E. Reinold Fett, Ph.D.
University of Illinois, 1955

PART I

The characteristics are presented of an automatic differential potentiometric titrator which is simple to operate and capable of precise and accurate titrations. With this titrator it is not necessary to know and set the end-point potential, because the electronic circuit computes the second derivative voltage of the ordinary potentiometric curve, and this voltage is ideally suited to trigger a relay system which turns off the buret at the inflection point of the titration. It is known that the inflection point is usually equal to or sufficiently close to the equivalence point to cause negligible error in a titration.

There are several advantages which characterize the automatic differential titrator. The circuit diagrams as presented illustrate that the equipment is simple, compact, inexpensive, and there are not any end point potentials to set or any other instrument adjustments to make. Other important advantages are that various types of reference and indicator electrodes can be used even though their absolute potentials shift from one titration to the next, or if the electrodes undergo a drift in potential during a titration.

The relay system prevents false end points from various types of electrode noise which occasionally occur in certain titration procedures, and this is illustrated with recorded curves for specific systems. It is also shown that tirant flow rates up to ten milliliters per minute are possible in some cases without appreciable overshoot of the equivalence point. Examples are also given where flow rates should not exceed about two milliliters per minute so that solution equilibria will be maintained. Much of the experimental data was obtained at relatively fast flow rates which would be especially desirable for routine titrations.

The titrator yields automatic titration results of excellent precision for precipitation, complex formation, aqueous and nonaqueous acid-base, oxidation-reduction, and multiple end-point titrations. The simplicity of operation of the automatic differential titrator coupled with its excellent precision and other characteristics discussed make it desirable for rapid titrations of all basic types.

PART II

In titanium casting operations, even low concentrations of chloride cause spattering of the molten metal and interfere with the production of satisfactory castings. It is therefore necessary to have a procedure by which the chloride content of titanium sponge can be accurately determined. In addition, the production of titanium sponge is increasing rapidly and methods for quality control must be capable of handling large numbers of samples.

The gravimetric and colorimetric procedures now available both involve a precipitation step in which the precipitate must stand overnight, and the ordinary gravimetric precipitation involves a reprecipitation step. It was the purpose of this investigation to establish a much more rapid determination of chloride in the range of 0.001 to 0.5% while retaining, or even improving, on the precision and accuracy of the accepted gravimetric method.

A 30 gram sample is dissolved in sulfuric acid, largely eliminating the difficulty in obtaining a truly representative small sample. In addition, the solution, through dilution, is identical to those used for present spectrochemical and wet chemical methods for nitrogen, iron, and magnesium.

The analysis is made potentiometrically using a concentration cell. The solution to be analyzed may either be a chloride-containing distillate of the original, or an original solution in which the titanium(III) has been oxidized to titanium(IV) to prevent destruction of the silver-silver chloride electrodes in the concentration cell. The distillation step takes approximately eight minutes while the oxidation takes about three minutes. An additional two to three minutes is required to make the potentiometric measurement.

The relative error is about 2% at concentrations of 0.01% chloride and above, while the limiting concentration is about 0.0008% chloride. 121 pages. \$1.51. Mic 56-355

CHEMISTRY, BIOLOGICAL

PART I: STUDIES ON THE ALKALINE HYDROLYSIS OF LECITHIN: PROPERTIES OF CYCLIC 1,2-GLYCEROPHOSPHATE. PART II: REACTIONS OF THE DOUBLE BOND OF SPHINGOSINE.

(Publication No. 15,183)

Norman Andrew Bates, Ph.D.
University of Illinois, 1955

Lecithin was hydrolyzed under mild alkaline conditions (0.5 N methanolic-aqueous KOH, 37°, 65 hours). Glycerophosphate (GP) and methyl glycerophosphate (MGP) were isolated from the reaction mixture by chromatography on

Dowex 2-OH⁻ and (along with traces of glycerylphosphorylcholine (GPC)) accounted for all the phosphorus present. There was no evidence for a GP-containing polymer proposed by French workers, and the properties of a mixture of MGP and GP account for the observed behavior of their "glycerophosphatogen."

Cyclic 1,2-glycerophosphate (CGP), which has been proposed as an intermediate in lecithin hydrolysis to explain phosphate migration, was prepared by the method of Dr. T. Ukita and characterized. It is stable over the range pH 3.5 to 8.0 at room temperature but hydrolyzed to GP in 0.1 N acid or base within 3 hours. Acid catalyzed decomposition in alcoholic solution yielded esters of GP.

Alkaline hydrolysates of lecithin and related compounds were paper chromatographed in isopropanol-5 N ammonia (2:1) in attempts to detect CGP as an intermediate. Negative results were obtained when lecithin was hydrolyzed with refluxing barium carbonate slurry or with 0.5 N alkali at room temperature and ethanol, isopropanol, or water as solvents. Benzyl GP was not readily hydrolyzed in refluxing barium carbonate slurry or pH 11 buffer at 90°, but GPC under the latter conditions yielded in addition to GP a small amount of material corresponding to CGP on paper strips. However the quantities were insufficient for further characterization or isolation.

The reactions of the double bond of sphingosine were investigated in attempts to convert sphingosine chemically to 1,3,4-trihydroxy-2-amino-octadecane and elucidate the stereochemistry of phytosphingosine.

Pure sphingosine was obtained from cerebroside by hydrolysis with methanolic sulfuric acid in overall yields of 10 to 12 per cent (after purification as the triacetyl derivative). Hydrolysis with IR-120-H⁺, aqueous sulfuric acid and tin, and barium hydroxide followed by ethanolic hydrochloric acid were investigated in attempts to increase the yield of sphingosine. The separation of sphingosine and related compounds by paper chromatography was also investigated.

The reaction of triacetylsphingosine with perphthalic acid at room temperature resulted in a 50 to 75 per cent uptake of peracid after 40 hours. Pure triacetylsphingosine epoxide (m.p. 137-138°, $\alpha_D^{20} = 15.1^\circ$) was isolated from the reaction mixture in 11 per cent yield by fractional crystallization.

A crude sphingosine sulfate preparation reacted rapidly with perphthalic acid at 4°. The reaction mixture was reduced with lithium aluminum hydride and the N-benzoyl derivative prepared. Fractional crystallization and alumina chromatography of the products yielded trace amounts of two crystalline fractions, neither of which corresponded to N-benzoylphytosphingosine.

123 pages. \$1.54. Mic 56-356

THE TOCOPHEROL AND VITAMIN A CONTENT OF SOME MARINE BLUBBER OILS

(Publication No. 15,601)

Christine Anderson Heller, Ph.D.
Cornell University, 1955

Five Marine blubber oils, that from the Pacific Harbor seal, the bearded seal, the beluga whale, the baleen whale

and the walrus, have been tested for their Vitamin A, carotene and tocopherol values. These oils are used in large daily amounts in the Alaskan Eskimo diet. They furnish from 40 to 50 percent of the calories.

These oils contain negligible amounts of carotene. They are fair sources of Vitamin A. But, because of the large amounts of these oils ingested daily by the Eskimo, they may contribute 30 to 100 percent of the recommended daily allowance of Vitamin A.

Vitamin A was determined biologically, using the method outlined in the U. S. Pharmacopoeia XIV. It was determined chemically by the Koehn-Sherman method. The bioassay values ranged from 32 to 75 percent of those obtained chemically.

The greatest discrepancy between chemical and bioassay values was in the walrus '51 oil. It is suggested that the low bioassay value for this oil is due in part to the development of rancidity.

The total tocopherol values ranged from 6.7 to 38.3 mg. per 100 grams of oil. There was good agreement between the values obtained by the molecular distillation method of Quaife and Harris and Krukowsky's modification of the Parker-MacFarlane direct method.

Practical suggestions, possible under the present Eskimo way of life, are suggested for maintaining the Vitamin A and tocopherol content of these oils during rendering and storage. 28 pages. \$1.00. Mic 56-357

STUDIES ON THE UTILIZATION OF NON-PROTEIN NITROGEN BY RUMEN MICROORGANISMS IN VITRO

(Publication No. 14,466)

Truman Verne Hershberger, Ph.D.
The Ohio State University, 1955

The utilization of non-protein nitrogen by rumen microorganisms is related to the nutritional quality of the ration. In order to identify some of the factors responsible for nutritional quality that increase the utilization of non-protein nitrogen, a study was made on the effect of three commercial nitrogen-containing preparations, pH and unidentified factors on the rate of growth of rumen microorganisms in a synthetic medium.

The inoculum for the 30 hour in vitro fermentation was obtained from a fistulated steer maintained on good-quality alfalfa hay. The rates of cellulose digestion and protein synthesis were used to evaluate the nitrogen sources and the unidentified factor materials.

In the first phase of the study, the utilization of nitrogen from ammoniated molasses (molatein), wheat hydrolysate (MC-11), and biuret was observed to be related to the availability of the nitrogen to rumen microorganisms.

Fifteen per cent of the total nitrogen in two samples of ammoniated molasses (15 per cent and 33 per cent protein equivalent) was liberated as ammonia nitrogen. The remainder of the nitrogen (85 per cent) was unavailable to rumen microorganisms in vitro, even in the case of a fistulated steer which was fed 1 lb. of ammoniated molasses per day for 123 days to permit the rumen microflora to adapt to the ammoniated compounds.

The nitrogen in wheat hydrolysate (MC-11), a by-product in the production of monosodium glutamate, was available to rumen microorganisms in vitro.

The nitrogen in biuret was unavailable to rumen microorganisms.

Since the addition of centrifuged rumen juice (Sharples) to a simple, synthetic medium inoculated with rumen microorganisms increased the rates of cellulose digestion and protein synthesis threefold to fourfold, fractionation studies were carried out on the supernatant to identify the substance(s) responsible for the increased rate of growth of rumen microorganisms, particularly cellulolytic microorganisms. In these studies, the vitamins, biotin and paraaminobenzoic acid, previously shown to increase the rate of cellulose digestion were included in the basal medium.

Steam distillation at pH 2.0 effectively separated the active cellulolytic factor from the supernatant, whereas separation of the acids on a silica gel column revealed that cellulolytic factor activity was obtained in the valeric acid fraction.

Volatile fatty acids were tested in vitro for cellulolytic factor activity. Only the acids, valeric, caproic, isovaleric, isobutyric and heptylic acid, showed factor activity in decreasing order. The response from valeric acid was so near maximum that it was designated as a new growth factor for rumen microorganisms.

Further investigations demonstrated that the nutritional requirement of the cellulolytic rumen microorganisms for valeric acid could be replaced by a mixture of valine and proline, but could not be replaced by alpha-hydroxy or alpha-keto derivatives of valeric or caproic acid.

Valeric acid appeared to be required only by the cellulolytic rumen microorganisms, for valeric acid did not increase the rate of growth of rumen microorganisms that metabolize cellobiose, maltose, glucose, or starch. Conversely, rumen microorganisms were shown to synthesize valeric acid during the digestion of starch. Furthermore, when starch was added to the medium as a source of energy, 40 per cent cellulose digestion was obtained.

The effect of pH on the rate of cellulose digestion and protein synthesis was also investigated. The optimum pH for the growth of the cellulolytic rumen microorganisms was found to be between 6.9 and 7.0. No cellulose digestion was obtained at pH 6.0 or 7.5.

The rate of growth of amylolytic rumen microorganisms was essentially maximum throughout the pH range 6.0 to 7.5. However, the rate of growth was decreased at pH 5.5.

176 pages. \$2.20. Mic 56-358

PART I. THE SYNTHESIS OF SOME BIS-(N,N-DIALKYL)-5-AMINOISOPHTHALAMIDES. PART II. STUDIES ON THE EFFECTS OF 1,-3-BIS-(2-ETHYLHEXYL)-5-METHYL-5-AMINO- HEXAHYDROPYRIMIDINE ON ANAEROBIC GLYCOLYSIS.

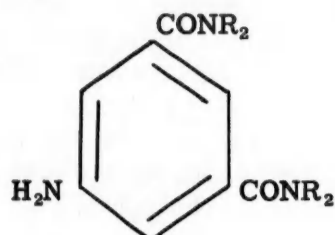
(Publication No. 15,139)

John Henry Kay, Ph.D.
Northwestern University, 1955

The dissertation is divided into two parts corresponding to two, distinctly different problems. These will be considered separately.

Part I. The synthesis of some Bis-(N,N-dialkyl)-5-aminoisophthalamides.

This study represents the synthesis of compounds of the type I:



The R groups selected were methyl, ethyl, n-propyl, i-propyl, n-butyl and i-butyl. The compounds were synthesized with a view to their possible possession of analgetic properties.

The method of synthesis involved conversion of 5-nitroisophthalic acid, the starting material, to the corresponding acid chloride. The acid chloride was then treated with the appropriate secondary amine to obtain the bis-(N,N-dialkyl)-5-nitroamide. The nitro-group of the latter was then catalytically reduced by hydrogen in the presence of platinum oxide to yield the bis-(N,N-dialkyl)-5-aminoisophthalamide.

The physical properties of both the 5-amino-compounds and the intermediate 5-nitro-compounds were recorded and the structures confirmed by analysis.

The 5-amino-compounds were pharmacologically tested for anti-inflammatory properties but little such activity was indicated. Pharmacologic tests for analgesic and antipyretic properties are in progress.

Part II. A Study of the Effects of 1,3-bis-(2-ethylhexyl)-5-methyl-5-amino-5-hydroxypyrimidine on Anaerobic Glycolysis.

This investigation concerned the action of a new compound, viz. 1,3-bis-(2-ethylhexyl)-5-methyl-5-amino-5-hydroxypyrimidine, on some aspects of anaerobic glycolysis. *Saccharomyces cerevisiae* was employed as the test organism and both living and cellularly disorganized systems of it were studied. Among the phases of the problem studied were the action of the test compound upon:

- 1) The acid-production which normally occurs during glycolysis.
- 2) Phosphate uptake and glucose disappearance during glycolysis.
- 3) The rate of carbon dioxide output during glycolysis.

The results indicated a marked inhibitory effect upon the glycolytic process in the living yeast cell. No apparent inhibition of the glycolysis occurred however when a cell-disrupted system was employed. A discussion of possible explanations for this phenomenon is included together with an attempt to correlate some of the properties of the compound with possible modes of action.

70 pages. \$1.00. Mic 56-359

CHEMICAL STUDIES OF INFLAMMATORY EDEMA, EXPERIMENTALLY INDUCED

(Publication No. 15,148)

Ilmar Merits, Ph.D.
Northwestern University, 1955

Inflammation was produced in rats by two methods and the passage of water, salts and protein into the interstitial space was studied. It was found that under the action of irritants water, salts and protein penetrated the interstitial space. When irritants were placed into the pleural cavity there was a similar passage of these constituents into the pleural fluid.

Anti-inflammatory agents when given prophylactically would cause a reduction in the net passage of water, salts and protein into the interstitial space and into the pleural cavity. Though there was a decreased net exchange of water, salts and protein the prophylactic use of anti-inflammatory agents caused the edema fluid to be more concentrated in respect to protein.

The pleural cavity method permitted more quantitative results due to the mechanics of the method and may be developed into an accurate procedure for testing anti-inflammatory drugs.

An attempt was made to explain the mechanism of the inflammatory response on the basis of the components of the edema fluid, however, the number of variables involved precluded any accurate calculations. A hypothesis was proposed and tested, with some success, that the edema fluid of acute, localized inflammation originates from the blood, passes through the capillary wall and leaves by drainage via the lymphatics and perhaps by re-absorption through the capillaries. On the basis of the results obtained it was suggested that the anti-inflammatory agents in some manner decreased the influx of water, salt and protein from the blood capillaries. Since all of the anti-inflammatory agents tested yielded similar patterns it was suggested that perhaps they acted through some intermediary substance which alters the permeability of capillaries and which may be liberated from ruptured cells.

Insofar as aspirin decreases the edema and does not seem to alter the pain threshold, it was suggested that the apparent analgesic action of this drug may be associated with its anti-inflammatory action.

143 pages. \$1.79. Mic 56-360

A STUDY OF SOME NON-ACIDIC GROWTH SUBSTANCES IN APPLE LEAVES

(Publication No. 15,607)

Lloyd Earl Powell, Jr., Ph.D.
Cornell University, 1955

This study deals with some ether extractable non-acidic growth substances found in apple leaves. The term "growth substance" includes growth-promoting and growth-inhibiting materials. Primary consideration was given to methods of handling the non-acidic growth substances — their extraction, purification, and chromatography — with less emphasis on their identification.

The growth substances were extracted from fresh and heat dried apple leaves with diethyl ether, and fractionated into acidic and non-acidic components with ether/sodium bicarbonate solution. The non-acidic fraction was chromatographed one-dimensionally on filter paper, using distilled water as the developer. The wheat coleoptile straight-growth test was used for bioassay work for the majority of the chromatograms, but the bean-rooting test and *Coleus* petiole abscission test were employed in a few cases. Some chromatograms were sprayed with various chemical reagents to detect certain compounds of the indole group.

By comparing many chromatograms there appeared to be at least four growth promoting and four growth inhibiting substances in the non-acidic fraction, when tested with wheat coleoptiles. The growth promoting substances also promoted root initiation in bean cuttings, but in limited experiments did not delay petiole abscission in *Coleus*. There was considerable interference from inhibitors on the one dimensional chromatograms, which made interpretation difficult in some instances. It was not possible to positively correlate any of the several color producing compounds with biological activity because of this interference. None of the growth substances were identified.

For satisfactory chromatography in water, it was imperative to remove the fatty materials. All the growth substances — accelerators and inhibitors — could be partitioned from hexane into acetonitrile, leaving fatty materials in the hexane, thus aiding purification. The growth substances could be adsorbed from hexane onto powdered sucrose columns while the fatty materials passed through into the eluate, also effecting better purification.

Even after complete removal of lipoidal material, the growth promoting substances were often at least partially masked by inhibitors after chromatography. For further clarification it will be necessary to employ some means of more clearly separating the various growth substances. Two dimensional chromatography, and/or differential adsorption from various solvents onto columns of adsorbants may provide the desired separation.

165 pages. \$2.06. Mic 56-361

THE ROLE OF METHYL- C^{14} -METHIONINE IN UREA AND PURINE SYNTHESIS IN THE RAT

(Publication No. 15,284)

David Arthur Vaughan, Ph.D.
University of Illinois, 1955

In a 24-hour period, expired carbon dioxide accounted for 21-30% of injected methyl- C^{14} -methionine in the white rat. In the same period, urea accounted for 6.3-6.7% of the urinary end-products of methyl- C^{14} -methionine in the rat. Using the amount of urea found in the urine of rats injected with C^{14} -sodium bicarbonate as a criterion, it was estimated that the urea produced from the injection of methyl- C^{14} -methionine represented 75-91% of the carbon dioxide fixation products arising from complete oxidation of the methyl group.

The methyl group of methionine was found to contribute to the synthesis of purines in the rat. This was measured by isolating and measuring the radioactivity of urinary

allantoin after injection with methyl- C^{14} -methionine. In the first 48-hour period, 0.025% of the injected radioactivity was found in the excreted allantoin. Employing daily injections of methyl- C^{14} -methionine, it was found that the specific activity of allantoin was still rising after 7 days, indicating that the specific activity of the body pool of methionine had not yet reached a plateau. Upon degradation of the allantoin molecule, all of the radioactivity was found in carbons 2 and 8, implying that a one-carbon intermediate arising from the methyl group is incorporated directly into the purine ring, without first being diverted into glycine or serine.

In order to determine the effect of a folic acid deficiency upon the incorporation of the methyl group of methionine into purines, rats were maintained for one month on a diet devoid of folic acid and containing the folic acid antagonist, "x"-methyl folic acid. The ability of these rats to incorporate methyl- C^{14} -methionine into allantoin was then compared with that of rats on a complete diet. The specific activity of allantoin isolated from the urine of the folic acid-deficient rats was found to be approximately three times as great as that isolated from the rats receiving the complete diet. This phenomenon seemed to be linked with the depressing effect of a folic acid deficiency on transmethylation, which would increase the oxidative metabolism of the methyl group. A one-carbon intermediate, which arises from the methyl group of methionine and is incorporated into the purine ring by a mechanism independent of folic acid, was suggested.

In order to observe the effect of vitamin B_{12} on the synthesis of purines, rats, obtained from a female receiving a vitamin B_{12} -free diet, were maintained on a vitamin B_{12} -free diet for 5 months. Again using the specific activity of urinary allantoin as a criterion, it was found that these rats were able to incorporate 2- C^{14} -glycine, methyl- C^{14} -methionine, C^{14} -formate, and β - C^{14} -serine into allantoin to the same extent as rats fed a complete diet. Using the results obtained from rats on a complete diet, the coefficient of utilization of methyl- C^{14} -methionine for the synthesis of allantoin was found to be 1/3 that of DL- β - C^{14} -serine and 1/6 that of C^{14} -formate. 82 pages. \$1.03. Mic 56-362

THE PURINE METABOLISM OF *MICROCOCCUS PYOGENES* VAR. *AUREUS*

(Publication No. 15,316)

Robert Charles Wood, Ph.D.
University of Maryland, 1955

Supervisor: Dr. Edward Steers

The purine metabolism of *M. pyogenes* has been studied in a comparative manner using paired strains of this microorganism. One of these strains (1-A) is the typical wild type; the other strain (1-ACR) is a mutant which requires adenine plus another purine for growth.

Studies with C^{14} -labeled adenine and guanine demonstrate that strain 1-ACR cannot interconvert polynucleotide adenine and guanine, whereas strain 1-A can convert guanine to adenine, but not the reverse.

2,6-Diaminopurine (DAP) inhibits the growth of strain 1-ACR by interfering with the utilization of guanine and

hypoxanthine. Growth with the corresponding ribosides or ribotides is not inhibited. The failure of ribose-5-phosphate and adenosine triphosphate to alter the inhibition of the purine bases by DAP is interpreted to mean that it inhibits the condensation of ribose phosphate with guanine and hypoxanthine, and not the synthesis of the ribose moiety. DAP functions in a similar manner in strain 1-A, where it inhibits the conversion of guanine-8-C¹⁴ to guanylic acid and hypoxanthine-8-C¹⁴ to inosinic acid. These effects are observed as an interference with the conversion of guanine to adenine and a depression of the incorporation of hypoxanthine-8-C¹⁴ into adenine and guanine.

DAP is not considered to be a natural intermediate in the interconversion of adenine and guanine because it will not support growth of strain 1-ACR and because DAP-2-C¹⁴ is a relatively poor precursor of polynucleotide guanine in both strains.

Strains 1-A uses formate-C¹⁴, bicarbonate-C¹⁴, glucose-C¹⁴, glycine-1, and -2-C¹⁴ for the biosynthesis of its polynucleotide purines. Strain 1-ACR, on the other hand, is deficient in its ability to use simple one-carbon sources for its purine biosynthesis and can only use glycine for this purpose.

Redox potential influences the means by which the purines of strain 1-A are synthesized. There is more incorporation of formate-C¹⁴ under stationary growth conditions than under anaerobic conditions. This precursor is thus considered representative of an aerobic mechanism for purine biosynthesis. When the medium is aerated, there is a generalized stimulation of the utilization of the elementary purine precursors instead of the preformed purines. Glycine is considered as representative of an anaerobic mechanism for purine biosynthesis, for its incorporation rises anaerobically (presumably in order to compensate for the drop in formate incorporation).

The effect of DAP on the utilization of various labeled substrates also indicates that several pathways exist for the biosynthesis of polynucleotide adenine and guanine. Strains 1-A and 1-ACR possess the well-known synthetic pathway consisting of the purine ribotides. This pathway functions principally aerobically. Strain 1-A also has a direct pathway to polynucleotide guanine which involves the purine bases. This latter pathway operates most effectively anaerobically. Although a direct route to polynucleotide adenine can be demonstrated in strain 1-ACR, it is not definite whether a similar pathway exists in strain 1-A or whether it involves the purine bases.

53 pages. \$1.00. Mic 56-363

CHEMISTRY, INORGANIC

OPTICAL ISOMERISM IN THE GALLIUM FAMILY

(Publication No. 15,211)

Edgar Howard Grahn, Ph.D.
University of Illinois, 1955

The members of the gallium family (gallium, indium, and thallium) may form chelate compounds of coordination

number of six. Orbital hybridization is necessary for the formation of these coordination species. If there are two *d* orbitals, three *p* orbitals and one *s* orbital available for bonding, there are formed *s-p-d* hybrid bonds which are directed toward the apices of an octahedron. Thus, orbital hybridization can be of the type $(n-1)d^2nsnp^3$ ("inner orbital") or $nsnp^3nd^2$ ("outer orbital"), where *n* equals the principal quantum number and *s*, *p*, and *d* are the corresponding orbitals.

An indication of the electron distribution of members of the gallium family indicates that "inner orbital" complexes would be impossible, as the $(n-1)d$ orbitals are already completely occupied and are not available for hybridization bonding. "Outer orbital" complexes would be formed with at least some ionic bonding to be expected. In potentially asymmetric complex species, the ligands might thus be free to move and racemization might then occur so rapidly that actual resolution of such species into optical enantiomorphs would be unlikely. However, if the "outer orbital" complexes are fairly stable (predominately covalent), at least partial resolution should be possible.

This study of optical isomerism in the gallium family is limited to investigations of two potentially asymmetric gallium(III) chelate species; namely, the tris(oxalato)gallate(III) ion and the gallium(III)ethylenediaminetetracetic acid complex. The geometry of each of these complexes is such as to cause asymmetry and lead to potential optical isomerism.

Evidence of optical isomerism has been sought through resolution of diastereoisomers and radioactive exchange studies. Resolution of alkaloid diastereoisomers of these two chelate species would indicate that the bonding of these "outer orbital" complexes is predominately covalent. Inability to resolve these compounds would indicate ionic bonding.

Exchange studies between the bound oxalate of the tris(oxalato)gallate(III) ion and the free radioactive oxalate ion would give further evidence of bonding characteristics. If a rapid exchange were noted, ionic bonding of the oxalato ligands to the gallium(III) ion could be assumed and the possibility of resolving the compound would be reduced. If the exchange were fairly slow, the bonding of the complex would be more covalent. It would be unusual to have a slow interconversion of *d* and *l* forms when there is a rapid exchange or substitution of attached groups.

The ionic character of bonds between the central gallium atom and the corresponding ligands of these "outer orbital" chelate species was substantiated in the following manner.

A. Lack of resolution of potentially optically active chelate complexes.

1. The *l*-strychnine, *l*-quinine, *d*-cinchonine, and *d*-tris(ethylenediamine) diastereoisomers of the tris(oxalato)gallate(III) ion were prepared. These compounds were not resolvable into their dextro or laevo forms by fractional crystallization, fractional extraction, or fractional precipitation techniques.

2. The *l*-brucine salt of $H[Ga(enta)(H_2O)]$ was prepared. It was not resolvable by fractional extraction techniques.

B. Exchange Reactions.

An exchange reaction between the tris(oxalato)gallate(III) ion and free radioactive oxalate ions was studied.

From an equimolecular mixture of ammonium tris(oxalato)gallate(III) and radioactive ammonium oxalate, aliquots were withdrawn periodically, and the tris(oxalato)gallate(III) ion was precipitated by adding tris(ethylenediamine)cobalt(III) chloride to form tris(ethylenediamine)cobalt(III) tris(oxalato)gallate(III). The radioactivity of these samples was constant within the limits of experimental error indicating an immediate interchange of oxalate ions between the bound oxalate of the tris(oxalato)gallate(III) ion and the free radioactive oxalate ions. The exchange was completed between the time of mixing and precipitation, this being approximately one minute.

Concomitant studies demonstrated the following.

A. pH titration studies with $H[Ga(enta)(H_2O)]$ proved that above a pH of four the complex was unstable.

B. The use of tris(ethylenediamine)cobalt(III) chloride as a precipitating agent for the tris(oxalato)gallate(III) ion resulted in a quantitative precipitation of tris(ethylenediamine)cobalt(III) tris(oxalato)gallate(III).

72 pages. \$1.00. Mic 56-364

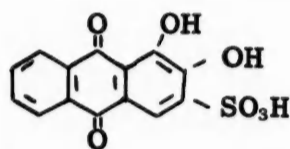
ALIZARIN SULFONATE COMPLEXES OF ZIRCONIUM AND HAFNIUM

(Publication No. 14,708)

Stanley Tariho Hirozawa, Ph.D.
The University of Wisconsin, 1955

Supervisor: Edwin M. Larsen

The reaction of dilute solutions (10^{-4} M) of zirconium and hafnium ions in perchloric and hydrochloric acids (0.1-0.3 M) with a solution of alizarin S,



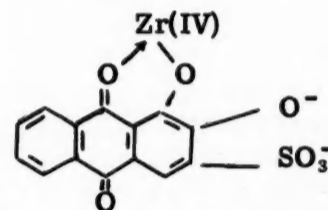
was studied polarographically. The alizarin S was purified of sulfate and alizarin impurities by fractional crystallization in ethyl alcohol and water. The final product was standardized by a potentiometric titration for the acid content, and by an amperometric titration with titanium(III) for the quinone content.

When alizarin S was titrated amperometrically with freshly prepared zirconium (hafnium) solutions, the first reaction line was curved. This indicated that two reactions were taking place, an initial rapid one, and a second slow one. The total current decreased to a sharp minimum at a metal ion to alizarin S ratio of about 0.8. The precipitate which formed initially flocculated at the end point. Upon the addition of more metal ion, the precipitate went into solution. The end point here was so broad that its stoichiometry could not be determined. With aged metal ion solutions the first reaction line was straight, and the minimum was rounded. The mole ratio of metal ion to alizarin S increased with the age of the metal ion solution; from 0.8 to 1.0 or greater for the zirconium solutions, and from

0.8 to 0.88 for the hafnium solutions. By reversing the titration, i.e., titrating the metal ion solution with alizarin S, the stoichiometry of the soluble complex could be determined. For the soluble complex, the ratio changed from 1.2 to 1.75 upon aging the zirconium ion solution, but for the hafnium solutions the ratio remained constant at 1.22. The changes in stoichiometry with the age of the metal ion solutions was probably related to the slow polymerization reactions of these cations.

Visible and ultra violet spectra were obtained on solutions whose composition closely corresponded to the end-points determined in the amperometric titrations. The visible spectra of a saturated solution of the insoluble complex and a solution of the soluble complex were about the same. If a very large excess of metal ion were added to the latter, the λ_{max} was shifted about 10 m μ to a lower wave length. In the ultra violet region (ethyl alcohol), the solution of the soluble complex absorbed at about 2-3 m μ lower wave length than the solution of the insoluble complex.

The electron change calculated from the polarographic data indicate that one of the quinonoid oxygens was involved in the chelation of the metal ion by alizarin S, and therefore the structure,



is proposed. The zirconium atoms of two such groups are believed to be bridged by a third zirconium atom in the solubilization reaction. 222 pages. \$2.78. Mic 56-365

THE FLAME SPECTROPHOTOMETRIC DETERMINATION OF MAGNESIUM

(Publication No. 14,766)

Jack Howard Jefferson, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Villiers W. Meloche

The flame spectrophotometric method, often referred to as Flame Photometry, is well established as an analytical method. In principle this method has the advantage of specificity, but it is well known that the presence of foreign substances at and above certain concentrations cause serious errors in results obtained by this method.

Since the effects of foreign substances become less pronounced at lower concentrations, it was desirable to determine the practicability of magnesium determinations at concentrations sufficiently low to avoid these effects.

The application of the Beckman DU Spectrophotometer with the Model 9200 Flame Attachment to the flame spectrophotometric determination of magnesium has been studied.

The most suitable instrumental conditions for measuring the magnesium radiation have been determined. The

magnesium radiation at 285.2 mu was found to be more suitable than that at 370.8 or 383 mu. The oxygen-acetylene flame was found to produce greater excitation of magnesium than the oxygen-hydrogen flame.

Exhaustive efforts have been made to find means of adjusting instrumental conditions so as to be able to reproduce a previously obtained working curve. Since all efforts failed a procedure has been developed taking this fact into account.

The precision and accuracy of results obtained in magnesium determinations using both a phototube and a photomultiplier as detectors have been determined for comparison. The photomultiplier was found to give somewhat greater precision and accuracy. Relative average deviations and relative errors of approximately one per cent or less could be realized using a photomultiplier.

The use of bucking circuit to nullify the intensity reading produced by background radiation was also studied. This circuit permitted a greater portion of the per cent transmission scale to be used for measuring the analytical radiation. However to use this circuit to advantage, wider slits were required. With wider slits the reproducibility of intensity measurements was correspondingly decreased. The net result was that precision and accuracy obtained with the use of the bucking circuit incorporated in the photomultiplier circuit was essentially the same as with the photomultiplier alone.

The effect of ions of metals commonly associated with magnesium on the determination of magnesium has been studied. With slitwidths of 0.2 mm (normally used with a phototube detector) none of the ions investigated interfered when working in the 0 to 25 ppm magnesium concentration range provided that the ratio of foreign ion to magnesium ion (in ppm) was of the order of 20 or less. With slitwidths of 0.02 mm (normally used with a photomultiplier detector) this ratio may be of the order of 50 or less. Larger ratios for several ions could be tolerated without interference.

The effects of hydrochloric, sulfuric, phosphoric and acetic acids have also been studied. Phosphoric and acetic acids at concentrations of 0.2 molar and greater interfered with the determination of magnesium. Sulfuric acid at concentrations of 0.5 molar and greater also interfered. Hydrochloric acid could be present at concentrations up to one molar without effect.

The effects of variations in atomization rates and in the character of the flame caused by variations or drifts in oxygen and acetylene pressures have also been investigated. These effects were found to be significant and were probably responsible for the difficulty in reproducing working curves. However, the procedure developed during this study minimizes errors from this source.

232 pages. \$2.90. Mic 56-366

PREPARATION AND STUDY OF HETEROPOLYNUCLEAR INORGANIC COMPLEXES

(Publication No. 15,255)

Robert Louis Rau, Ph.D.
University of Illinois, 1955

Part I: Preparation of Heteropolynuclear Inorganic Complexes

A survey of the literature dealing with complexes containing two or more metal atoms, where these atoms are the same or different, indicates that in most cases the metal atoms are bridged by groups which are capable of forming a covalent bond with one of the bridged metals and a coordinate covalent bond with the other metal of the bridged pair. Chloride and bromide ions often serve as bridging groups in this manner.

The work of Kurtz¹ has shown that alpha amino acids, such as ornithine and lysine, form complexes with copper(II) in which the carboxyl and alpha amino groups are masked by coordination with the metal, thereby leaving the terminal amine available for further reaction. It has been shown that this terminal amine undergoes many of the reactions common to organic amines without attacking the coordinated alpha amine, or destroying the complex.

The reaction of bis-lysine copper(II) with bis-salicylaldehyde nickel(II) in aqueous solution has been shown to give a complex in which two moles of the nickel-salicylaldehyde complex condense with the terminal amino groups of the copper-lysine complex to form a new complex containing one copper and two nickel atoms. A similar complex containing one nickel and two copper atoms as well as one containing one copper and one palladium atom has also been prepared. The condensation of functional groups on the ligands of different complexes, to give a new species containing both complexes, is believed to be unique in the preparation of heteropolynuclear complexes.

Part II: Study of Heteropolynuclear Inorganic Complexes

Since the introduction of a bright tin-nickel alloy plate in 1951, considerable interest has been aroused concerning the nature of the species responsible for the deposition of tin and nickel in roughly equal atomic proportions from solutions containing stannous chloride, nickel chloride, sodium fluoride and ammonium bifluoride. Recent work^{2,3} has indicated the existence of a tin(II)-fluoride complex of the type SnF_4^- . It has been postulated that this complex reacts with nickel(II) to form a new species of the type $\text{NiSnF}_4^{2,3,4}$.

The method of continuous variation, using refractive index as the measured property, has been used to determine the nature of the complex formed in solutions containing tin(II), nickel(II) and fluoride ions. These studies have indicated the formation of SnF_4^- , which in turn has been shown to form NiSnF_4 in the presence of nickel(II). Other complexes of the type NiSnF_x^{4-x} where x is 1, 2 or 3 have been shown to form. There is no indication of any complex formation in the absence of fluoride. It has been postulated that these complexes contain at least one fluoride bridge.

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136 pages. \$1.70. Mic 56-367

POLAROGRAPHY WITH A MERCURY POOL CATHODE IN STIRRED SOLUTIONS

(Publication No. 15,529)

Douglas John Rosie, Ph.D.
Cornell University, 1955

A large mercury pool cathode in stirred solutions was found to be suitable for use as the indicating electrode in polarographic analysis. Because of the low charging current of this electrode, it is possible to obtain polarograms of solutions in the micro-molar range. The increase in sensitivity of this type of electrode over the dropping mercury electrode is more than two hundred. The polarograms have the same shape as those obtained with a dropping mercury electrode but have no maxima. The current fluctuations caused by the drop growth are also absent. Using the pool electrode, it was possible to analyze solutions as dilute as 10^{-6} M with the same accuracy and reproducibility with which 10^{-4} M solutions could be analyzed at the dropping mercury electrode.

The following ion-amalgam reductions were studied: lead, thallium, copper, and cadmium. The ion-metal reductions investigated were nickel and indium. The cobaltic-cobaltous and the chromate-chromic reductions were chosen as examples of ion-ion reductions. The reductions of azo, peroxy, carbonyl, and nitro compounds were the examples chosen to illustrate the molecule-molecule reductions.

A rapid, simple method that does not require extensive electrolysis or a gas coulometer is proposed for the determination of the number of electrons involved in polarographic reductions. Reverse polarograms obtained with this electrode also give information concerning the reduction mechanisms and reduction products not always available from the dropping mercury electrode.

A study has been made on the effect of various substituents on the ease of reduction of aromatic nitro compounds.

Investigations were carried out to determine whether the accumulation of one metal in the mercury electrode would affect the reduction of a metal with a more negative half-wave potential. It was found that, except with non-amalgamating metals, the only limitation is that the half-wave potentials be sufficiently separated so as to allow development of both waves.

One of the chief disadvantages of the method was that the presence of a reduced non-amalgamating metal in the electrode seriously altered the electrode characteristics. Another disadvantage is the limited voltage range of the pool electrode.

80 pages. \$1.00. Mic 56-368

QUALITATIVE AND QUANTITATIVE ANALYSIS OF MULTI-COMPONENT SYSTEMS BY X-RAY DIFFRACTION

(Publication No. 15,291)

Julie Chi-Sun Yang, Ph.D.
University of Illinois, 1955

The qualitative and quantitative analyses of several binary and ternary systems were carried out by the x-ray powder diffraction method, and a critical experimental study was made for the first time of the details of techniques for analyzing systems of this complexity.

Synthetic mixtures with the same components as the starting materials in the manufactured products were used for investigation. Under controlled conditions the products formed by solid state reaction were tested from stage to stage.

The specimen preparation is the most important step in determining reproducibility and accuracy of the x-ray analysis. The optimum working conditions and selection of suitable intensity peaks for evaluation were found by plotting trial calibration curves, and the conditions giving the graph with the least deviation from linearity was adopted for measurement.

Two methods were used for quantitative determinations:

1. Method of Clark and Reynolds with the Presence of An Internal Standard

The calibration curves were constructed by plotting the intensity ratios of the component 1 and the internal standard with background and deadtime corrections $(\frac{I_1}{I_0})_{b,d}$ against percentage of component 1 in the sample. The data were obtained from a series of synthetic mixtures with the concentration of the components varying from 10 to 90%. The accuracy found was around 5%.

This method is limited to a relatively small number of components present in the mixture. The binary mixture of NH_4NO_3 -KCl actually consists of five components including NH_4Cl , KNO_3 formed by solid state reaction and the internal standard CaF_2 . When the method was extended to a ternary system of original compounds, it failed to yield accurate results because the $\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}$ introduced has so complicated a structure.

2. Direct Method of Leroux, Lennox and Kay with the Absence of Internal Standard

This method has the advantage of eliminating the weighing and uniform mixing of an internal standard with the sample to be analyzed. Calibration curves were constructed by plotting the intensity ratio of the component 1 in the sample and that of pure component 1 $(\frac{I_1}{I_0})_{b,d}$ to the weight fraction of component 1 in the sample. The values of the ratio of the mass absorption coefficients of the sample and that of the pure compound 1 $(\frac{\mu_s^x}{\mu_1^x})$ were found by absorption measurement of the direct x-ray transmission through the sample. $(\frac{I_1}{I_0})_{b,d}$ values were determined by diffraction measurement. These data yielded values of X - the mole fraction of a component. The experimental values of $(\frac{\mu_s^x}{\mu_1^x})$ could be checked with the theoretical values calculated from the following equation: $\mu_s = \mu_1 X_1 + \mu_2 X_2$.

Whereas x_1 and x_2 denoted the concentration of component 1 and 2 in the sample and μ_1 and μ_2 were the corresponding mass absorption coefficients.

This method was also limited to small numbers of components present in the mixture and also to these systems in which no solid state interaction takes place among the components. Consequently, for this particular system chosen, it could be used for the determination of the binary systems in which interactions do not occur, such as the $\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}$ -KCl system. An accuracy of 5 to 7% could be achieved in this case.

Thus the present work has involved a critical examination of the x-ray powder diffraction method of quantitative analysis as applied to 2,3,4 and 5-component salt systems, and has established the inherent complexities and limitations of two principle techniques when applied to multi-component systems such as the important modern fertilizers with NH_4NO_3 , KCl and $\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}$ as initial solid ingredients, never before analyzed successfully in the as-is state. Very important has been the proof of unsuspected solid-state reactions in dry-mixed powders, both by the appearance of characteristic lines in patterns, and by the aberrations in calibration working curves.

209 pages. \$2.61. Mic 56-369

CHEMISTRY, ORGANIC

MOLECULAR REARRANGEMENTS AND THE CHEMISTRY OF SOME ISOMERIC CHOLESTEROLS

(Publication No. 13,665)

Edward Joseph Becker, Jr., Ph.D.
Princeton University, 1954

The rearrangement of epicholesteryl p-toluenesulfonate (IX) was studied in the aqueous acetone, potassium acetate system, under conditions which normally lead to the formation of 3-5cyclosterols. It was hoped that an isomeric 3-5cyclocoprostanol isomer of the normal cholesterol could be thus prepared, however, no evidence for the existence of such a compound was found. The products formed in the rearrangement of (IX) were $\Delta^{3,5}$ cholestadiene (X) and Δ^5 cholesten-4 β ol (XI), the former in predominant yield. Methylation of (XI) gave 4 β methoxy Δ^5 -cholestene (XII). This ether was shown to be identical with the ether "B" isolated from the same rearrangement when run in anhydrous methanol with potassium acetate.

The synthesis of Δ^4 cholesten-6-one (XVIII) was accomplished via cholestan-5 α 6 β diol (XV) by oxidation to cholestan-5 α ol-6-one (XVII) and then dehydration of this compound to (XVIII). The ketone was reduced by lithium aluminum hydride to give Δ^4 cholesten-6 α ol (XIX). The acetate (XX) and the ether (XXI) of this alcohol were prepared. The alcohol (XIX) was oxidized by the Oppenauer method to (XVIII) and was also partially isomerized to Δ^4 cholesten-6 β ol (XXVII), though the yield was small. The reduction of cholestan-5 α ol-6-one was shown to give (XV) with lithium aluminum hydride.

Cholestan-5 α 6 α diol (XXII) was synthesized by a sodium

and alcohol reduction of (XVII), simultaneously giving a large quantity of cholestan-6 α ol (XXIII). To firmly establish the structure of (XXII), the diol was also prepared by osmium tetroxide hydroxylation of Δ^5 cholestene (XIV). The acetate (XXV) of the diol (XXII) was dehydrated to give the unsaturated acetate (XX), illustrating the α configuration at C₆. The 6 β isomer was prepared by the dehydration of cholestan-5 α 6 β diol-6 β acetate (XVI) which furnished Δ^4 cholesten-6 β acetate (XXVI). Saponification of this acetate gave the corresponding unsaturated alcohol, which was non-crystalline. This alcohol (XXVII) was methylated to give 6 β methoxy- Δ^4 cholestene (XXVIII) which was shown to be identical with the methyl ether "A" isolated from the rearrangement of epicholesteryl-p-toluenesulfonate (IX) in anhydrous methanol with potassium acetate.

Saponification experiments with the acetates (XX) and (XXVI) indicate that (XX) is hydrolyzed about eight times faster than (XXVI). This result is in agreement with the results of similar saponification data and lends support to the configurations assigned.

A lithium aluminum hydride reduction of Δ^5 cholesten-3 β 4 α diol-3 β p-toluenesulfonate (XXX) gave Δ^5 cholesten-4 α ol (XXXI). The methyl ether (XXXII) of this alcohol was prepared. The Oppenauer oxidation of (XXXI) gave the corresponding unsaturated ketone (XXXIII) and a large amount of $\Delta^{3,5}$ cholestadiene (X). This ketone was also prepared by the rearrangement of 2 α bromocholestan-3-one (XXXV). The lithium aluminum hydride reduction of this ketone gave Δ^5 cholesten-4 α ol (XXXI), giving thus, the same configuration as was produced in the C₆ position.

The infra-red spectra of the isomeric alcohols, (XI), (XIX), (XXVII) and (XXXI) are shown and discussed. The reductions of saturated and $\alpha\beta$ unsaturated C₆ ketones are discussed in view of the anomalous behavior of the unsaturated compounds. The reason for this behavior is suggested. A mechanism for the rearrangement of epicholesteryl-p-toluenesulfonate (IX) is proposed.

83 pages. \$1.04. Mic 56-370

A SYNTHESIS OF α -ETHOXYMETHYLENE AND α -CHLOROMETHYLENE CARBOXYLIC ESTERS

(Publication No. 13,670)

Newell Stedman Bowman, Ph.D.
Princeton University, 1955

The reaction between chloroform and alkylmalonic esters has been found to proceed rapidly and in high yields to give a gemdichloride. Because of the reaction between sodium ethoxide and chloroform to yield orthoformic ester, it was necessary to prepare the sodium salt of the alkylmalonic ester from metallic sodium in an inert solvent. Investigations of various solvents showed xylene to be ideal because of its availability and relatively high boiling point. Since chloroform can react with two alkylmalonic ester residues instead of the desired one, it was found that a ninefold excess of chloroform was the optimum amount to minimize this side reaction. At the same time sufficient xylene was added to bring the reflux temperature to 100° since below this the reaction proceeded too slowly.

The chlorine atoms in the adduct formed above were

quite unreactive. Reflux with aqueous alkali slowly split out the element of ethyl chlorocarbonate to give an α -substituted β -chloroacrylic acid. The ethyl ester of this acid was prepared by treating the dichloro compounds with an equivalent of sodium ethoxide.

When two moles of sodium ethoxide were used, a fission occurred in which diethyl carbonate was eliminated. Saponification of the resulting α -ethoxymethylene carboxylic ester yielded an acid which, on reflux with dilute mineral acid, underwent decarboxylation and hydrolysis of the ethoxyl grouping to give an aldehyde two carbon atoms longer than the starting alkyl halide. The reaction was studied for the butyl, benzyl, and carbethoxymethyl derivatives of malonic ester.

In the case of the benzyl compound, the double bond was found to remain in the position demanded by the general reaction scheme. That conjugation with the ring had not occurred was shown by a comparison of the ultraviolet spectra of both the α -chloromethylene and α -ethoxymethylene derivatives with various cinnamoyl compounds.

The reaction between the butyldichloro compound and sodium ethoxide in alcoholic medium yielded not only the expected α -ethoxymethylene carboxylic ester, but also butylmalonic ester. Reaction mechanisms are proposed to explain this unexpected result as well as the formation of the ethoxymethylene compounds instead of the acetals which had been anticipated.

Attempts to form both the dichlorides and tetrachlorides from dimalonic esters of the type



were unsuccessful. The case where $n = 0$ was abandoned after two attempts had yielded only unreacted starting material. Increasing the length of the chain to $n = 1$ failed since under basic reflux 1,1,3,3-tetracarbethoxypropane underwent a reverse Michael addition to give malonic ester and methylenemalonic ester. When n was increased to 2, a Dieckmann-type cyclization occurred yielding 2,5-dicarbethoxycyclopentanone-1. The lowest member which could be expected to give the desired product ($n = 4$) was not attempted. 82 pages. \$1.03. Mic 56-371

A STUDY OF THE SYNTHESIS OF γ -PYRONES AND γ -THIAPYRONES BY AROMATIZATION

(Publication No. 15,192)

Debabrata Choudhury, Ph.D.
University of Illinois, 1955

In order to determine the feasibility of their aromatization, a series of substituted 3,5-dibenzylidenetetrahydro- γ -pyrones was prepared by condensation of tetrahydro- γ -pyrone with the following aldehydes: benzaldehyde, *p*-methylbenzaldehyde, *p*-methoxybenzaldehyde, *p*-ethoxybenzaldehyde, 3,4-dimethoxybenzaldehyde, 2,3-dimethoxybenzaldehyde, 3,4-methylenedioxybenzaldehyde, 1-naphthaldehyde, *p*-nitrobenzaldehyde and *m*-methylbenzaldehyde. It was found possible to convert these dibenzylidenepyrones to their aromatic isomers by treatment with palladium-on-carbon in diethylene glycol. Using this method the following dibenzyl- γ -pyrones were obtained: 3,5-dibenzyl- γ -pyrone, 3,5-di-(*p*-methylbenzyl)- γ -pyrone,

3,5-di-(*p*-methoxybenzyl)- γ -pyrone, 3,5-di-(*p*-ethoxybenzyl)- γ -pyrone, 3,5-di-(3',4'-dimethoxybenzyl)- γ -pyrone, 3,5-di-(3',4'-methylenedioxybenzyl)- γ -pyrone and 3,5-di-(α -naphthylmethylene)- γ -pyrone. The formation of a number of dibenzylpyrones with different substituents serves to demonstrate the generality of this aromatization method.

The infrared spectra of both series of compounds were determined; the ultraviolet absorption spectra of 3,5-dibenzylidene- γ -pyrone and 3,5-dibenzyl- γ -pyrone were determined and compared. The structure of dibenzyl- γ -pyrones were assigned on the basis of their ultimate analyses, infrared absorption spectra, and lack of color reaction with sulfuric acid.

The synthesis of γ -thiapyrones by aromatization was also investigated. A series of 3,5-substituted dibenzylidenetetrahydro- γ -thiapyrones was prepared by condensation of tetrahydro- γ -thiapyrone with the following aldehydes, using piperidine acetate as the catalyst: benzaldehyde, *p*-methylbenzaldehyde, *p*-isopropylbenzaldehyde, 1-naphthaldehyde, *p*-methoxybenzaldehyde, 3,4-dimethoxybenzaldehyde, *p*-dimethylaminobenzaldehyde and *p*-nitrobenzaldehyde. All attempts to aromatize these compounds were unsuccessful. The following catalysts were tried: palladium-on-carbon, hydrogen bromide in acetic acid, cobalt polysulfide and α -pyridone. Attempts to aromatize the corresponding sulfones under varied conditions were also unsuccessful.

The structures of the dibenzylidenetetrahydro- γ -thiapyrones and the corresponding sulfones were assigned on the basis of ultimate analyses and infrared absorption spectra. 105 pages. \$1.31. Mic 56-372

THE SOMMELET REACTION

(Publication No. 15,200)

John Robert Demuth, Ph.D.
University of Illinois, 1955

As a result of their recent studies of the mechanism and scope of the Sommelet reaction, Angyal and his associates (J. Chem. Soc. 1949, 2700; 1953, 1742) have concluded that a primary amine is formed by the reaction of an arylmethyl halide and hexamine. The amine is dehydrogenated by methyleneamine ($CH_2=NH$), formed from hexamine or its hydrolysis products, to the aldimine, and this in turn is hydrolyzed to the aldehyde. The mechanism proposed by Angyal for this reaction accounts for many of the features of the Sommelet reaction; perhaps its most notable shortcoming is its failure to account for the fact that secondary amines give much poorer yields of aldehydes than do similar primary amines. The present work was undertaken to examine other mechanistic possibilities, and to study further the fate of secondary amines.

The possibility that amines alkylate hexamine and pass through the same intermediate hexaminium salts as are formed by arylmethyl halides and hexamine was explored but had to be abandoned since no hexaminium salt could be isolated from anhydrous reaction mixtures of benzylamine hydriodide or tribenzylamine hydriodide and hexamine.

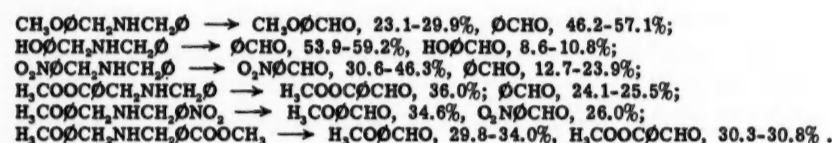
An attempt was made to obtain good yields of aldehydes from amines by substituting methylene-*t*-butylamine, a stable imine, for the easily hydrolyzed methyleneamine

which according to the Angyal mechanism is the oxidizing agent in the Sommelet reaction; however, only small amounts of aldehydes were obtained.

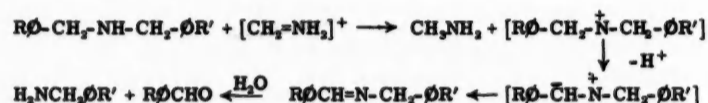
Pyruvic acid, which is known to be effective in converting α -amino acids to aldehydes, proved to be unsatisfactory for converting amines to aldehydes in acetic acid solution.

The behavior of a number of secondary amines in the Sommelet reaction was studied. N-Methylbenzylamine gave a 15% yield of benzaldehyde, I, whereas N-isopropylbenzylamine gave only 6% of I. Dibenzylamine afforded I in yields ranging from 25-30%; *p,p'*-dinitrodibenzylamine and *p,p'*-dicarbomethoxydibenzylamine gave the corresponding aldehydes in yields of 31-48 and 12.2%.

Six unsymmetrical dibenzylamines were synthesized and subjected to the reaction. They yielded the following results:



In the majority of cases in which an unsymmetrical dibenzylamine was used, the ratio of the amounts of aldehydes produced was the inverse of that which would be predicted if the Angyal mechanism for the reaction were operative. A modification of the Angyal mechanism is therefore suggested. The modified mechanism explains the decreased yield of aldehyde when a secondary amine is used as a starting material, it is compatible with all the known features of the reaction, and it permits more accurate prediction of aldehyde ratios to be made when an unsymmetrical dibenzylamine is used in the Sommelet reaction. This mechanism is shown below using a dibenzylamine as an example.



This mechanism differs from the Angyal mechanism in that the latter proposes the loss of the hydride ion from one of the carbon atoms α to the nitrogen, and the formation of a coördinate-covalent bond between carbon and nitrogen by the free electron-pair of the latter atom. Hydrolysis of the double bond formed in this way produces the aldehyde.

The stability of the double bond in Schiff's bases under the conditions of the Sommelet reaction was demonstrated by refluxing for two hours a buffered solution of *p*-hydroxybenzaldehyde and *p*-methoxybenzylamine, hydrolyzing the Schiff's base which had formed, and analyzing the resulting solution for both anisaldehyde and *p*-hydroxybenzaldehyde. Less than 0.5% of anisaldehyde could be detected, while 92.3% of the *p*-hydroxybenzaldehyde was recovered.

90 pages. \$1.13. Mic 56-373

SYNTHESES AND REACTIONS OF BIFUNCTIONAL DIENES

(Publication No. 15,298)

James Peter Economy, Ph.D.
University of Maryland, 1955

Supervisor: Professor William J. Bailey

The syntheses of 2-vinylbutadiene and 1,2,4,5-tetramethylenecyclohexane have been accomplished. These two compounds were of considerable interest, for they represented the first known example of compounds, containing two diene systems, that could undergo consecutive Diels-Alder reactions to give only a single compound.

The 2-vinylbutadiene was synthesized in four steps from aconitic acid in an over-all yield of 38%. The crucial steps in the synthesis were the reductive acetylation with lithium aluminum hydride and acetic anhydride in a 94% yield and the pyrolysis of a triacetate in a 43% yield. The structure of the triene was proved by analysis, ultraviolet and infrared absorption, and conversion to a known derivative through an intermediate Diels-Alder adduct.

The 1,2,4,5-tetramethylenecyclohexane was synthesized in six steps in an over-all yield of 0.27%. The crucial steps in this synthesis were the reductive acetylation in a 95.5% yield and the pyrolysis of a tetraacetate in 1.08% yield. The structure of the tetraene was proved by conversion to a known derivative through an intermediate Diels-Alder adduct.

Diels-Alder polymerizations of bifunctional dienes with bifunctional dienophiles were investigated. Thus, five polymers were obtained, by reacting 2-vinylbutadiene with benzoquinone, *N,N'*-*m*-phenylene-bismaleimide, ethylene diacrylate, *N,N'*-methylene-bisacrylamide and with itself, respectively. Melting points, solubilities and molecular weights were determined, whenever possible. This type of reaction represented a new method for polymerization and yielded a new class of high melting, rigid polymers.

The Diels-Alder adducts of both 2-vinylbutadiene and 1,2,4,5-tetramethylenecyclohexane with cyclic dienophiles appear to be excellent starting materials for the general synthesis of angular and linear condensed polynuclear aromatic hydrocarbons. Thus, with 2-vinylbutadiene the derivatives of tetraphene, hexaphene and the unknown octaphene were prepared. With the tetraene the derivative of the unknown nonacene was prepared. Aromatization of these intermediates is being investigated.

These polynuclear aromatic hydrocarbons are of considerable interest in the medicinal field as possible carcinogens.

78 pages. \$1.00. Mic 56-374

SOME REACTIONS OF CHLOROFLUOROOLEFINS WITH THE HALIDE IONS

(Publication No. 15,516)

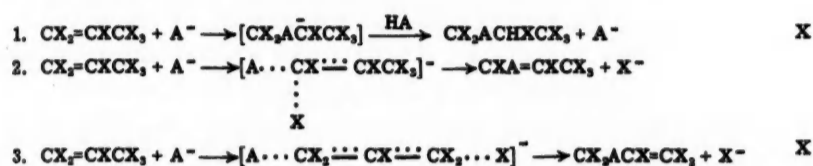
John Fried, Ph.D.
Cornell University, 1955

A study of the behavior of highly fluorinated olefins has been underway in this laboratory for some time. As part

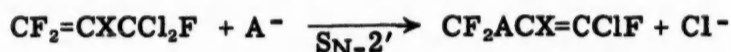
of this general investigation a study of the reactions of some chlorofluoroolefins with the halide ions was undertaken.

A search of the literature had not revealed any successful attempts effecting the direct nucleophilic replacement of chlorine, bromine, or iodine on an otherwise fully fluorinated carbon atom. However, results obtained in this laboratory, have shown that certain fluoroolefins having an allylic chlorine were highly reactive in replacement reactions. This reactivity has been correlated with the ease of anionic attack initiated at the ethylenic double bond.

In the present work the reactions of a number of fluoroolefins with halide ions, especially fluoride were investigated. Products corresponding to three types of processes were established: addition of HX , replacement of vinyl halogen, and replacement of allylic halogen. These reactions were best interpreted on the basis of the general mechanism previously proposed in this laboratory.



The proposed S_N-2' mechanism for replacement of allylic halogen was tested by analysis of the products obtained from the reaction of two unsymmetrical olefins, $CF_2=CHCCl_2F$ and $CF_2=CFCCl_2F$. Only products corresponding to the S_N-2' mechanism (path 3) were found.



In none of the cases studied was there evidence for products arising by the direct replacement of halogen, S_N2 .

The reactivity of the halide ions was in the order: $F^- > Cl^- > I^-$, which was the inverse of the usual order of reactivity found for direct nucleophilic replacement reactions.

The HX addition reaction with fluoride ion furnished a new synthetic method for obtaining the CF_3CHXR_x structure from olefins such as $\text{CF}_2=\text{CXR}_x$ and $\text{CClF}=\text{CXR}_x$.

CONDENSATION AND ADDITION REACTIONS OF ENAMINE SALTS

(Publication No. 15,206)

Richard Warren Fulmer, Ph.D.
University of Illinois, 1955

Inasmuch as there is no direct synthetic structure proof of 10-methylquinolizidine, the product obtained by the action of methylmagnesium iodide on $\Delta^{5(10)}$ -dehydroquinolizidinium perchlorate, its structure was assigned by comparison of derivatives with those of the eight other isomeric methylquinolizidines. In order to accomplish this, 3-methylquinolizidine was synthesized for the first time and its racemates separated; 2-methylquinolizidine was obtained by a reaction sequence that yielded a mixture of racemates which were separated (whereas previously

each racemate had been reported as the sole product from different reactions). 1-Methylquinolizidine was synthesized by a new method and compared with the previous literature reports. One literature reference on 2-methylquinolizidine showed discrepancies which led this research directly to a preliminary synthetic investigation in the pyrrocoline series.

The dehydrogenating action of mercuric acetate was investigated with the methylquinolizidines and other saturated tertiary amines. With the quinolizidine compounds, the unsaturation in the ternary iminium function was thought to be in the $\Delta^{5(10)}$ -position. A small amount of dehydrogenation-hydroxylation accompanied the usual action of mercuric acetate on 1-methylquinolizidine giving, in addition to the 1-methyl- $\Delta^{5(10)}$ -dehydroquinolizidinium perchlorate, smaller amounts of a compound which was shown to be 1-methyl-1-hydroxy- $\Delta^{5(10)}$ -dehydroquinolizidinium perchlorate.

Since the electronic configuration of the enamine salt (ternary iminium) system is similar to that of a carbonyl group, some exemplary reactions involving the methylene group of the $-\text{CH}_2-\text{C}=\text{N}^+$ configuration were attempted.

Condensation of such a system with aromatic aldehydes was accomplished, although oxidation with selenium dioxide and bromination with N-bromosuccinimide failed.

167 pages. \$2.08. Mic 56-376

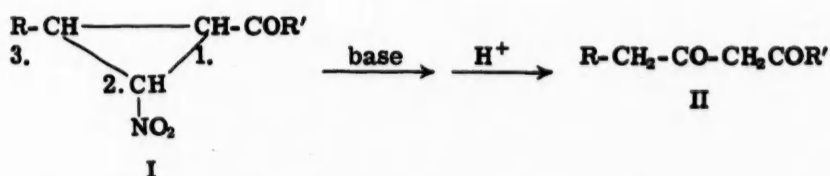
**CYCLOPROPANES XIV: A. ATTEMPTS TO
SYNTHESIZE A COMPLETELY SUBSTITUTED
NITROCYCLOPROPYL KETONE. B. SOME REACTIONS
OF 3,4-DIBROMO-1-PHENYL-2-BENZYL-
2,3-DIMETHYL-1-BUTANONE.**

(Publication No. 14,554)

John Robert Holum, Ph.D.
University of Minnesota, 1954

Major Adviser: Lee Irvin Smith

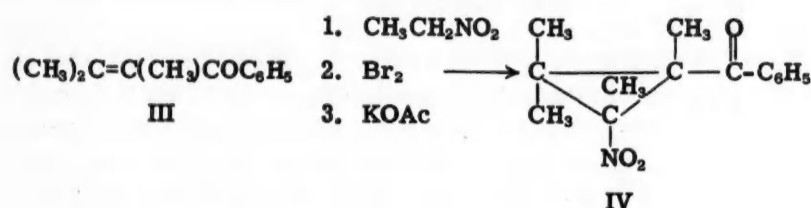
The action of alkaline reagents upon nitrocyclopropyl ketones which contain a hydrogen atom attached to the C₂-carbon atom of the cyclopropane ring leads to 1,3-diketones:



Smith and Engelhardt (1) suggested a mechanism for this conversion which began with an attack by the alkaline reagent upon the hydrogen atom attached to the C_2 -position. One of the consequences of this mechanism was that a 1,3-diketone would not be expected to form if no hydrogen atom were situated at the C_2 -position. Showell (2) predicted that a completely substituted nitrocyclopropyl ketone, one in which no hydrogen atoms were attached directly to the cyclopropane ring, would be inert to the action of alkalis.

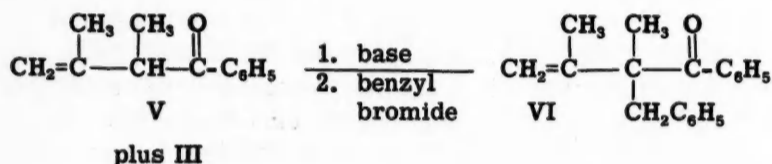
Kohlhase,(3) however, found evidence that a completely substituted nitrocyclopropyl ketone might react with metal alkoxides.

In order to test these theories and mechanisms, experiments designed to synthesize a completely substituted nitrocyclopropyl ketone were conducted. One synthetic scheme which was studied involved the method of synthesis which has been used frequently by workers in this field:

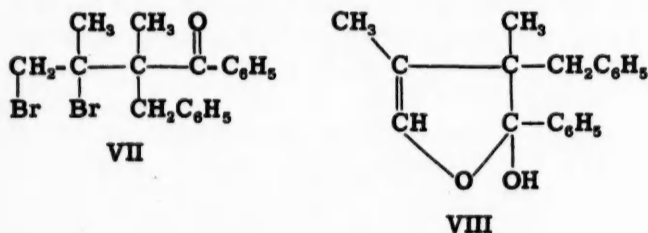


Colonge and Chambion (4) reported the first synthesis of α,β -dimethylcrotonophenone, III. When their synthesis was repeated by this author the product possessed properties which suggested that a mixture of α,β -dimethylcrotonophenone (III) and 1-phenyl-2,3-dimethyl-3-buten-1-one, V (the β,γ -unsaturated isomer of III), was the actual product of the synthesis of Colonge and Chambion. It was further concluded that the β,γ -unsaturated isomer (V) predominated in the mixture. This mixture could not be separated by fractional distillation. The use of the mixture in the synthesis of IV was unsuccessful.

During the investigation of another synthesis of IV, the alkylation of the unsaturated ketonic mixture, III and V, with benzyl bromide was studied. Sodium amide (commercial), potassium amide and potassium *tert.* butoxide were used as bases in this reaction which gave 1-phenyl-2-benzyl-2,3-dimethyl-3-buten-1-one, VI, as the product.



As part of attempts to prepare a solid derivative of VI, its reaction with bromine was studied. The reaction was slow and hydrogen bromide was evolved; the product, however was the expected dibromide, 3,4-dibromo-1-phenyl-2-benzyl-2,3-dimethyl-1-butanone, VII. The alkaline hydrolysis of VII was investigated. Action of dilute aqueous sodium hydroxide in refluxing dioxane upon VII resulted in



the formation of a bromine-free solid in average yield of 50%. The structure of this solid was shown to be VIII by spectral and degradative evidence.

216 pages. \$2.70. Mic 56-377

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PART I: THE ATTEMPTED SYNTHESIS OF 2,2,8,8-TETRAMETHYLCYCLONONANONE.

PART II: STUDIES IN THE

- 1,4-POLYMETHYLENEBENZENE SERIES;
 A. SYNTHESIS AND ATTEMPTED RESOLUTION OF 2-(ω -CARBOXYPROPYL)-1,4-NONAMETHYLENEBENZENE. B. ATTEMPTED SYNTHESIS OF 1,4-OCTAMETHYLENEBENZENE.

(Publication No. 15,497)

Karl Lee Lockwood, Ph.D.
 Cornell University, 1955

The optically active compounds may almost entirely be grouped into two broad classes: those whose activity depends on the presence of one or more asymmetric atoms in the molecule, and those whose dissymmetry arises from a restriction of rotation about some molecular bond. The object of this research was the investigation of certain aspects of the stereochemistry of several compounds which bear some similarities to the optically active compounds of the second class.

In Part I, an attempt was made to synthesize 2,2,8,8-tetramethylcyclononane (I), since the Fisher-Hirshfelder-Taylor models of this molecule indicated that two non-interconvertible conformational enantiomorphs were capable of existence and persistence; the molecule ought to be resolvable if this were true. It appeared that rotation of strategic atoms about certain bonds in the molecule is restricted because some of the annular hydrogens are forced into steric interference with each other.

The approach to I involved an acyloin condensation on diethyl 2,2,8,8-tetramethylazelaate (II), to be followed by a Clemmensen reduction on the resultant 3,3,9,9-tetramethyl-2-hydroxycyclononane. However, all attempted acyloin condensations on II resulted in little or no yield of product; only polymer was formed. The cyclization appeared to be highly unfavored because of the presence of the four methyl groups.

The synthetic path to II involved condensation (with sodamide) of two moles of isobutyrophenone with one of pentamethylene dibromide to give 2,8-dimethyl-2,8-dibenzoylnonane (III); this was cleaved to 2,2,8,8-tetramethylazelaamide (IV) by additional sodamide. Hydrolysis of IV followed by esterification of the acid yielded II.

Fisher-Hirshfelder-Taylor models predict that a polymethylene chain connecting the *para* positions of a benzene ring must contain at least eight carbon atoms, and, further, any such chain of eight, nine, or ten carbon atoms is not free to rotate about the benzene ring because of interaction of the chain with the aromatic hydrogens. These predictions were investigated in Part II of this research.

Substitution of any suitable group into one of the open positions of a 1,4-polymethylenebenzene in which the bridge is not free to rotate about the ring should result in the formation of a pair of resolvable enantiomorphs. To

determine if this were the case, 2-(ω -carboxypropionyl)-1,4-nonamethylenebenzene (V) was synthesized. It was obtained from ethyl γ -phenylbutyrate (VI) and γ -carbethoxybutyryl chloride (VII) in a Friedel-Crafts reaction, followed by catalytic reduction of the ethyl γ -[p-(ω -carbethoxypropyl)-benzoyl]-butyrate (VIII) (over palladium-on-charcoal) to give 1-(ω -carbethoxypropyl)-4-(ω -carbethoxybutyl)-benzene (IX). The acyloin condensation on IX afforded a small yield of the desired compound; this was reduced by a Clemmensen procedure to give 1,4-nona-methylenebenzene (X) which was succinoylated to produce V.

All attempts at resolving V, in which α -phenylethylamine, cinchonine methohydroxide, and quinine methohydroxide were employed as the resolving agents, resulted in no conclusive evidence that the acid is optically active. Whether the laboratory conditions or the predictions of the theory are at fault cannot be determined until a successful resolution of the compound is achieved.

By a similar route, except that ethyl hydrocinnamate (XI) was substituted for VI, 1-(ω -carbethoxyethyl)-4-(ω -carbethoxybutyl)-benzene (XII) was prepared in good yield. Attempts at cyclizing XII by an acyloin condensation as with IX may have produced very small yields of the desired cycle, since some evidence was obtained that 1,4-octamethylenebenzene (XIII) was produced in a Clemmensen reduction of the product from the condensations.

However, XII was shown to be almost completely inert to the conditions of the acyloin reaction, affording neither cyclic nor polymeric products. The fact that this unsymmetrical ester XII is unreactive, as are several other esters which have been reported, seems to indicate that the explanation for this observed inertness is stereochemical rather than electronic in origin. In any case, it appears certain that a chain of carbon atoms containing fewer than eight carbon atoms cannot connect the *para* positions of a benzene ring.

102 pages. \$1.28. Mic 56-378

I. THE SYNTHESIS OF TROPONES VIA AROMATIZATION. II. DEHYDROGENATION AND HYDROXYLATION OF 1-METHYLDECAHYDROQUINOLINE BY MEANS OF MERCURIC ACETATE.

(Publication No. 15,245)

Lee Alan Miller, Ph.D.
University of Illinois, 1955

I. The Synthesis of Tropones Via Aromatization

It has been shown that 3,7-dibenzylidene-1,2-cycloheptadiones, prepared by the condensation of a series of aromatic aldehydes with 1,2-cycloheptadione, may be aromatized smoothly through the use of palladium-on-charcoal in triethylene glycol to the corresponding 3,7-dibenzyltropolones.(1,2) The purpose of this investigation was to study the effect of palladium-on-charcoal on 2,7-dibenzylidenecycloheptanones.

It was found that a series of 2,7-dibenzyltropones, namely, 2,7-dibenzyltropone, 2,7-di(p-methoxybenzyl)-tropone, 2,7-di(p-methylbenzyl)tropone, 2,7-di(p-dimethylaminobenzyl)tropone, 2,7-di(3,4-dimethoxybenzyl)tropone

and 2,7-di(3,4-methylenedioxybenzyl)tropone, may be prepared, in yields ranging from 5 to 57%, by aromatization of the corresponding 2,7-dibenzylidenecycloheptanones with palladium-on-charcoal in triethylene glycol.

Catalytic hydrogenation of 2,7-dibenzyltropone results in the formation, after the takeup of three molar equivalents of hydrogen, of the known 2,7-dibenzylcycloheptanone. The structure of 2,7-dibenzyltropone was further established through a combination of evidence obtained by ultraviolet and infrared spectra, elemental analysis, and color tests with sulfuric acid. The substituted dibenzyltropones were assigned structures on evidence obtained through a study of their infrared spectra and in analogy to 2,7-dibenzyltropone.

II. Dehydrogenation and Hydroxylation of 1-Methyl-decahydroquinoline By Means of Mercuric Acetate

The reaction of either *cis*- or *trans*-1-methyldecahydroquinoline with mercuric acetate leads to the formation of a hydroxy-enamine. A hydroxy-amine, formed through the lithium aluminum hydride reduction of the perchlorate salt of the hydroxy-enamine, has been shown to be identical to 1-methyl-10-hydroxydecahydroquinoline. This information, coupled with the fact that treatment of $\Delta^{1(9)}$ -octahydroquinoline methiodide with mercuric acetate results in the formation of the same hydroxy-enamine as obtained from 1-methyldecahydroquinoline, indicates that the hydroxy-enamine is 1-methyl-10-hydroxy- $\Delta^{8(9)}$ -octahydroquinoline.

Both diastereoisomeric racemates of 1-methyl-10-hydroxydecahydroquinoline have been isolated and, although the evidence is not conclusive, the stereochemistry has been tentatively assigned.

1-Methyl-10-hydroxy- $\Delta^{1(9)}$ -octahydroquinolinium perchlorate has been shown to undergo many of the typical nucleophilic reactions expected of an enamine salt.(3)

168 pages. \$2.10. Mic 56-379

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- (3). A. S. Hay, Thesis, Doctor of Philosophy, University of Illinois, 1955.

NUCLEAR SPECTRA OF ARSENIC-76 AND RHENIUM-184 AND RADIATIVE ELECTRON CAPTURE IN GERMANIUM-71

(Publication No. 14,482)

Bruce Bernard Murray, Ph.D.
The Ohio State University, 1955

Adviser: J. D. Kurbatov

Nuclear Spectrum of Arsenic-76

Arsenic-76 is a radioactive isotope of nuclear charge between those of two stable isobars, germanium-76 and selenium-76. It decays by beta and gamma ray emission

to selenium-76. The decay scheme is complex and not well established.

Arsenic-76 was produced by neutron activation at Oak Ridge National Laboratory. It was purified chemically by distillation of the arsenic trichloride in a stream of hydrogen chloride. Hold-back carriers of antimony and sodium were added to remove radioactive impurities. The samples were mounted for measurement in the form of arsenic sulfide.

The photospectrum of arsenic-76 was studied in a thick lens magnetic spectrometer with radiators of uranium, lead and tin. The results showed the presence of gamma rays of energies of 0.55, 0.65, 1.20, 1.40, and 2.05-m.e.v., with relative intensities of 1.0, 0.20, 0.21, 0.02, and 0.04 respectively. Similar results were obtained with a single-channel gamma scintillation instrument.

Coincidence measurements were made using a two-channel scintillation spectrometer. The beta-gamma coincidence showed the 1.20-m.e.v. gamma ray to be in coincidence with the 1.76-m.e.v. beta component, and the 0.55-m.e.v. gamma ray to be in coincidence with the 2.41-m.e.v. beta component. No beta-gamma coincidences could be detected between the 2.05-m.e.v. gamma ray and the 0.36-m.e.v. beta component. Gamma-gamma coincidence measurements showed coincidences between the following pairs of gamma rays: 0.55-m.e.v. and 0.65-m.e.v., 0.55-m.e.v. and 2.05-m.e.v., and 1.2-m.e.v. and 1.4-m.e.v. The last two pairs yielded a very low coincidence counting rate.

The beta spectra were measured in a thick lens spectrometer, and four beta components were obtained. The energies which were determined are 2.965-m.e.v., 2.41-m.e.v., 1.76-m.e.v. and 0.36 m.e.v. and the branching ratio 51.5, 31.0, 16.0 and 2.5, respectively.

The disintegration scheme of arsenic-76 is shown in Figure 23 on page 54 of the dissertation.

Radiative Electron Capture in Germanium-71

Germanium-71 is a pure electron capture isotope that disintegrates to gallium-71. The total disintegration energy can be determined by observation of the continuous electromagnetic radiation.

Germanium metal of high purity was activated at Oak Ridge National Laboratory and purified chemically from arsenic impurities. The germanium was complexed as the fluoride in acid solution, and the arsenic precipitate as the sulfide. The measurements of the continuous electromagnetic radiation were made with a single channel scintillation spectrometer. The end-point energy obtained for the continuous spectrum was 223 ± 10 .

Energy Levels of Tungsten-184 Appearing in the Disintegration of Rhenium-184

Rhenium-184 is an electron capture isotope which has a complex gamma spectrum. It was investigated to determine the energies of its gamma rays and their relative intensities.

This isotope was produced in the 60-inch cyclotron at the University of California, Berkeley. Tantalum-180 was bombarded with alpha particles to produce the (α, n) reaction which yields rhenium-184. A competing ($\alpha, 2n$) reaction exists which produced rhenium-183.

The rhenium was separated from the tantalum target by addition of .05 milligrams of rhenium carrier and precipitation of the heptasulfide.

The measurement of rhenium on a single-channel scintillation spectrometer showed seven gamma rays with periods of approximately 44-51 days. A 50-day and a 44 ± 5 -hour period were obtained with a Geiger counter. The 44-hour period was previously reported to be an isomeric state of rhenium-184. The energies of the gamma rays found were 60 ± 5 , 110 ± 5 , 170 ± 10 , 240 ± 10 , 320 ± 15 , 780 ± 30 and 840 ± 30 kv. The relative intensities of the gamma rays were determined by scintillation techniques to be $60/110/170/240/320/780/840 = 1/.14/.16/.04/.02/.75/1.37$ respectively, and these were assigned to rhenium-184.

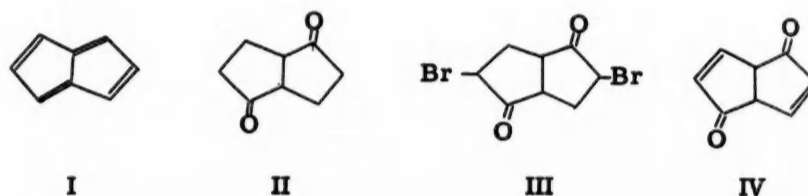
108 pages. \$1.35. Mic 56-380

STUDIES ON PENTALENE SYSTEMS

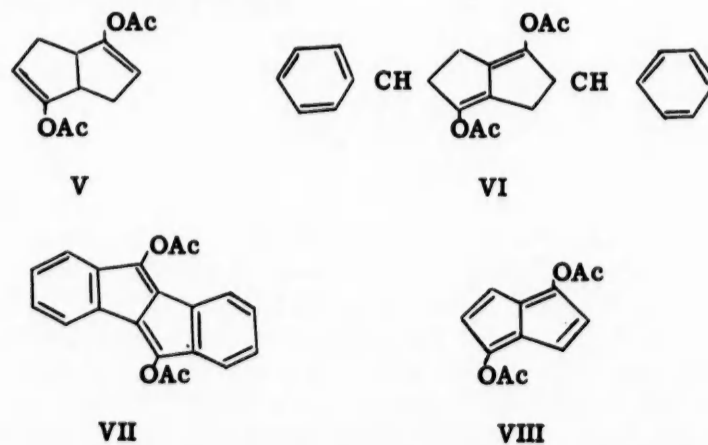
(Publication No. 13,001)

Allan Gilbert Osborne, Ph.D.
University of Washington, 1955

Extension of the theory of aromaticity to produce a completely generalized theory has lead to the investigation of compounds having $4n$ rather than $4n+2$ π -electrons characteristic of the classical aromatic systems. The simplest representative of this group, having 8 π -electrons, which would be expected to be planar is bicyclo[3.3.0]octatetraene or pentalene (I).

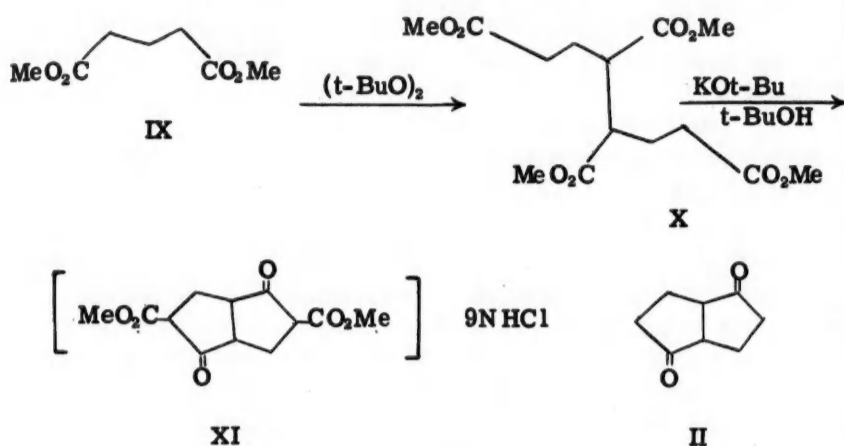


The present work involved: 1) the improvement of the synthetic route to bicyclo[3.3.0]octane-2,6-dione (II); 2) the investigations of methods to improve the process of dehydrobromination of 3,7-dibromobicyclo[3.3.0]octane-2,6-dione (III) to bicyclo[3.3.0]octa-3,7-diene-2,6-dione (IV); 3) the preparation of 2,6-diacetoxibicyclo[3.3.0]octa-2,6-diene (V), 2,6-diacetoxy-3,7-dibenzalbicyclo[3.3.0]octa-1,5-diene (VI), 1,4-diacetoxy-2,3,5,6-dibenzpentalene (VII), and 1,4-diacetoxypentalene (VIII); and 4) the development of a reliable method of estimating strain based ultimately on thermochemical data.



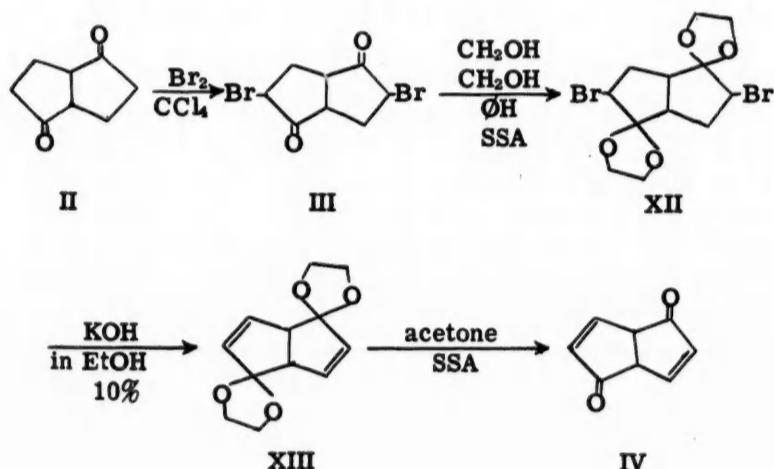
Bicyclo[3.3.0]octane-2,6-dione (II) was prepared according to the following route reducing to two steps (three reactions) that which required previous workers five.

Dimethyl glutarate (IX) was coupled, using di-*tert*-butyl peroxide to induce the formation of free radicals, to produce tetramethyl 1,3,4,6-hexanetetracarboxylate (X), which was condensed with potassium *tert*-butoxide in *tert*-butanol



to 3,7-dicarbomethoxybicyclo[3.3.0]octane-2,6-dione (XI), which was not isolated, but rather decarbomethoxylated in the crude to bicyclo[3.3.0]octane-2,6-dione (II).

Bicyclo[3.3.0]octa-3,7-diene-2,6-dione (IV) was prepared in the same manner as by previous workers in which 3,7-dibromobicyclo[3.3.0]octane-2,6-dione (III) is prepared from bromination of bicyclo[3.3.0]octane-2,6-dione (II), or as an alternate and better route in the present work, from

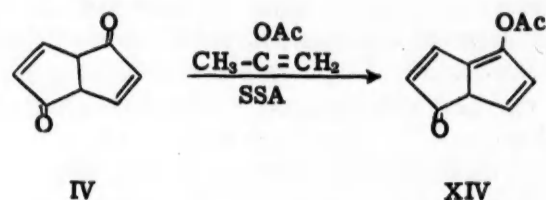


the bromination of 2,6-diacetoxibicyclo[3.3.0]octa-2,6-diene (V) which gives a more stable isomer of 3,7-dibromobicyclo[3.3.0]octane-2,6-dione (III) than does direct bromination of the ketone. From 3,7-dibromobicyclo[3.3.0]octane-2,6-dione (III), 3,7-dibromobicyclo[3.3.0]octa-2,6-dione bis-ethyleneketal (XII) is prepared by acid-catalyzed ketalization with ethylene glycol in benzene and subsequently dehydrobrominated to bicyclo[3.3.0]octa-3,7-diene-2,6-dione bis-ethyleneketal (XIII) which is in turn subjected to acid-catalyzed exchange with acetone to produce bicyclo[3.3.0]octa-3,7-diene-2,6-dione (IV).

Other methods of dehydrobromination of 3,7-dibromobicyclo[3.3.0]octane-2,6-dione (III) were attempted using, for example, *N,N*-dimethylformamide and acetonitrile, resulting in no reaction or producing indeterminate results.

The dienol diacetates, 2,6-diacetoxibicyclo[3.3.0]octa-2,6-diene (V) and 2,6-diacetoxy-3,7-dibenzalibicyclo[3.3.0]octa-1,5-diene (VI) were prepared by the action of isopropenyl acetate and sulfosalicylic acid catalyst on the corresponding diketones. Although quantitative analytical

data is lacking, it is almost certain that 1,4-diacetoxy-2,3,5,6-dibenzpentalene (VII) was also prepared in a small quantity in a similar manner, while the attempt to prepare 1,4-diacetoxypentalene (VIII) resulted in a failure, possibly to produce a small quantity of 2-acetoxibicyclo[3.3.0]octa-1,3,7-triene-6-one (XIV).



The strain energy in pentalene was estimated to be 27-31 kcal./mole. From consideration of this value, quantities estimated from heat of enolization (and free energy of enolization), and the quantum mechanically calculated resonance energy of pentalene (37-41 kcal./mole), it was estimated that the resonance energy of pentalene should most reasonably be in the range of 10-27 kcal./mole with the lower value being more probable.

No evidence has been brought forth in this work to indicate that pentalene could not exist under normal conditions, but considerations from observations of enol acetylation experiments tend to indicate that pentalene might be stable only under the mildest of reaction conditions.

211 pages. \$2.64. Mic 56-381

STUDY OF THE CELLULOSE METHYLATION REACTION

(Publication No. 13,723)

Ludwig Rebenfeld, Ph.D.
Princeton University, 1955

The cellulose methylation reaction was examined regarding the distribution of substituents along the cellulose polymer. The distribution of the methoxyl groups was determined by use of the technique of quantitative paper partition chromatography which was shown to be far superior to the classical methods of analysis that have been used in the past.

Methylcelluloses prepared heterogeneously and homogeneously in the laboratory as well as a commercial product "Methocel" were examined and the experimental distribution curves were compared with theoretical distribution curves. The theoretical curves were calculated on the assumption of the availability of all hydroxyl groups in cellulose and these curves represent a random distribution of substituents along the polymer chain. The deviation of the experimental curves from the theoretical distribution values was interpreted to indicate that different mechanisms are operative when the methylation of cellulose is homogeneous or heterogeneous in nature.

Heterogeneous partial methylation of solid alkali cellulose with dimethyl sulfate yielded products predominantly trisubstituted on the fiber surface and virtually unsubstituted in the inner core of the fiber. This was taken to indicate that the course of heterogeneous methylation consists initially of a rapid surface reaction followed by a

comparatively slow diffusion of reactants into the inner portion of the fiber where further methylation can proceed.

Homogeneous methylation of cellulose dissolved in trimethyl benzyl ammonium hydroxide by the use of dimethyl sulfate yielded products where the distribution of methoxyl groups followed more closely the theoretical distribution of substituents than in the heterogeneous case. However, the significant deviation of the experimental values from the theoretical curves was interpreted in terms of a micellar dispersion of cellulose in the particular dispersing agent that was employed.

Commercial methylation, where gaseous methyl chloride is reacted with alkali cellulose, resulted in products where the distribution of methoxyl groups adheres most closely to the theoretical curves. Since the underlying assumption required for the construction of the theoretical curves was the availability of all the hydroxyl groups of cellulose, it must be concluded that these hydroxyl groups are available in commercial methylation. Such availability must be concluded despite the heterogeneous nature of the commercial methylation, and it must therefore also be concluded that diffusion of the small gaseous methyl chloride molecules is facile compared to the diffusion of dimethyl sulfate during the heterogeneous laboratory methylation.

The partial methylation of cellulose in anhydroglucose units that are mono- and disubstituted in addition to those that are completely substituted and to those that are unsubstituted. This partial substitution of units can give rise to several isomers both in the monosubstituted and in the disubstituted cases. These isomers were qualitatively identified and the results indicate the absence of 6-monomethyl glucose and 3,6-dimethyl glucose and the presence of all the other possible isomers. This was found to be true regardless of the degree of substitution or the method of preparation of the methylcellulose. The results were interpreted in terms of relative reactivities of the three sorts of hydroxyl groups in each anhydroglucose unit.

87 pages. \$1.09. Mic 56-382

THE DETERMINATION OF TERMINAL ETHYLENIC UNSATURATION IN ORGANIC COMPOUNDS

(Publication No. 13,725)

Karl Hutcheson Roberts, Ph.D.
Princeton University, 1955

A simple and unique qualitative procedure for the chemical determination of terminal unsaturation in organic compounds has been developed. The procedure is based on a combination of three reactions: the reaction of potassium permanganate with the unsaturated compound to form a glycol with a primary alcohol grouping; the reaction of the resulting glycol with periodic acid to give formaldehyde and a higher aldehyde; and the specific reaction of formaldehyde with chromotropic acid to give a violet colored dye of unknown composition.

The adaptability of the above-described combination of reactions for the qualitative detection of terminal unsaturation was established by applying the procedure to a variety of unsaturated compounds. In general, the compounds which contained a terminal ethylenic bond gave a strong

positive test for formaldehyde, whereas the compounds without terminal unsaturation gave a negative formaldehyde test. A few compounds, such as citraconic and aconitic acids which contain a double bond closely associated with a hydroxyl or carboxyl group and can undergo rearrangement or dehydration and decarboxylation, gave positive tests even though there was no terminal unsaturation present.

In order to utilize this method for the quantitative determination of terminal unsaturation, the effect of the various variables on the stoichiometric yield of formaldehyde from terminal unsaturated groups was studied. The optimum conditions for the conversion of the unsaturated compound to two aldehydes was combined with a distillation procedure to separate the formaldehyde from the excess periodic and iodic acids present prior to the development of the color with chromotropic acid. A linear but non-stoichiometric relationship was found between the amount of formaldehyde recovered and the amount of terminally unsaturated compound taken. Therefore, an empirical calibration curve for 10-11 undecylenic acid was necessary before 2-8 mg. portions of this acid in the presence of as much as 160 mg. of other unsaturated acids were analyzed.

In the distillation procedure a blank correction for the formaldehyde obtained from a volume of alcohol equal to the total volume of alcohol used in each determination had to be applied. The cause of this blank was traced to the oxidative attack of ethyl alcohol by periodic acid rather than to the presence of glycol or similar impurities in the alcohol.

Separating the excess oxidizing agents by precipitation was investigated as a means of avoiding this blank and any undesirable side reactions which might occur in the reaction mixture during the distillation. Lead acetate was found to be a suitable precipitant for the periodate and iodate ions. In the precipitation procedure, the reaction mixture was diluted to a known volume with ethyl alcohol and an aliquot of the supernatant liquid was taken for analysis for formaldehyde. This procedure gave more consistent results and required less time than the distillation method.

The modified procedure was tested by determining the quantities of formaldehyde liberated by known amounts of undecylenic acid and hexene-1. In each case the amount of formaldehyde found varied linearly with the weight of unsaturated compound taken but the results were still not stoichiometric. However, quantitative determinations of terminally unsaturated compounds were carried out by first preparing a calibration curve from known amounts of the compound to be determined. Furthermore, this modified procedure was applied to the determination of itaconic acid. This acid gave almost theoretical yields of formaldehyde over a considerable concentration range whereas erratic results had been obtained by the distillation procedure. Even in the presence of succinic, malic, maleic, and fumaric acids, respectively, the modified procedure gave good results for the determination of the itaconic acid present in these mixtures.

123 pages. \$1.54. Mic 56-383

THE STEREOSPECIFIC SYNTHESIS OF dl-YOHIMBANE AND INITIATION OF THE SYNTHESIS OF YOHIMBINE

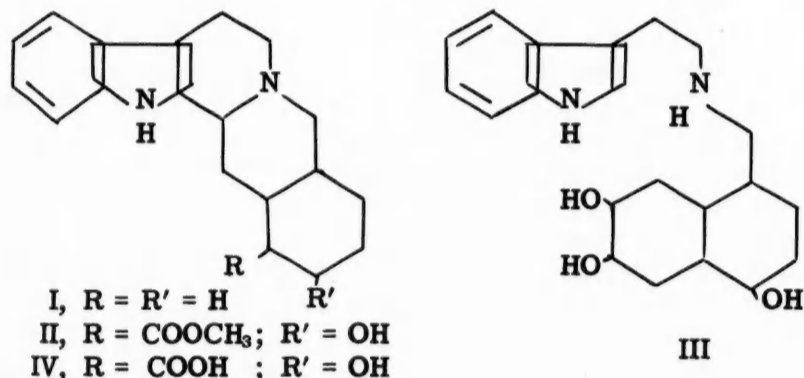
(Publication No. 14,738)

Maurice Shamma, Ph.D.
The University of Wisconsin, 1955

Supervisor: Assistant Professor Eugene E. Van Tamelen

PART I: The Stereospecific Synthesis of dl-Yohimbane.

dl-trans-Hydrindan-2-one, on oxidation with perbenzoic acid, afforded the lactone of dl-trans-2-hydroxymethyl-hexahydrophenylacetic acid, m.p. 38-39°; transformation of the lactone into ethyl dl-trans-2-bromomethylhexahydrophenylacetate, b.p. 129° at 1.4 mm., was accomplished by the action of alcoholic hydrogen bromide at room temperature. Alkylation of tryptamine with the bromoester in boiling ethanol in the presence of potassium carbonate led directly to the lactam of dl-trans-N-(β-3'-indolylethyl)-2-aminomethylhexahydrophenylacetic acid, m.p. 243-245°. The latter substance was cyclized by means of phosphorus oxychloride in benzene to a yellow, crystalline solid (m.p. 196-198°), the analysis of which was consistent with its formulation as the dichlorophosphate of dl-Δ³-dehydroyohimbane. Hydrogenation of this salt over Adams catalyst gave after treatment with aqueous alkali a high yield of dl-yohimbane I, m.p. 180°, which was identified by comparison of its infra-red spectrum with that of



yohimbane derived from the natural source — tracings of both substances dissolved in chloroform were identical in every detail. This synthesis, therefore, allows the unequivocal assignment of the relation between the hydrogen atoms common to rings D and E as trans.

PART II: Initiation of the Synthesis of Yohimbine.

Condensation of p-benzoquinone with butadiene afforded in high yield the Diels-Alder adduct 1,4-diketo-1.4.5.8.-9.10-cis-hexahydronaphthalene. Reduction of the adduct with zinc and acetic acid gave 1,4-diketo-cis-Δ⁶-octalin. A Darzens glycidic ester condensation of the reduced adduct with ethyl chloroacetate, using potassium tertiary butoxide as the base, yielded ethyl β-(4-keto-1.2.3.4.5.8.-9.10-octahydronaphthyl-1) glycidate. Hydrolysis and decarboxylation of the glycidic ester afforded an oily 4-keto-1.2.3.4.5.8.9.10-octahydronaphthyl-1 carboxaldehyde. Reduction of this keto-aldehyde with lithium aluminum hydride gave a crystalline 1-hydroxymethyl-4-hydroxy-1.2.3.4.5.8.9.10-octahydronaphthalene, m.p. 125-126°. Treatment of the latter material with performic acid and

subsequent hydrolysis of the formate ester yielded a powdery substance, m.p. 170-175°, which proved to be 1-hydroxymethyl-4,6,7-trihydroxy-decahydronaphthalene. This tetrol afforded a monotosylate derivative, 1-tosyloxy-methyl-4,6,7-trihydroxy-decahydronaphthalene, m.p. 184-185°, which on treatment with liquid ammonia in a sealed tube yielded the corresponding amino-triol derivative, 1-aminomethyl-4,6,7-trihydroxy-decahydronaphthalene. Efforts are at present being made to condense this amine with indolethyl bromide. The resulting adduct III should then cleave on treatment with sodium metaperiodate to give a homoyohimbine hemiacetal which could ultimately be degraded and oxidized to yohimbic acid IV or one of its stereoisomers. Since yohimbic acid IV has already been converted to yohimbineII, a synthesis of yohimbic acid IV would amount to a synthesis of yohimbine II itself.

105 pages. \$1.31. Mic 56-384

REACTIONS OF THIOLS WITH PERFLUORO AND CHLOROPERFLUOROOLEFINS UNDER FREE RADICAL AND IONIC CONDITIONS

(Publication No. 15,535)

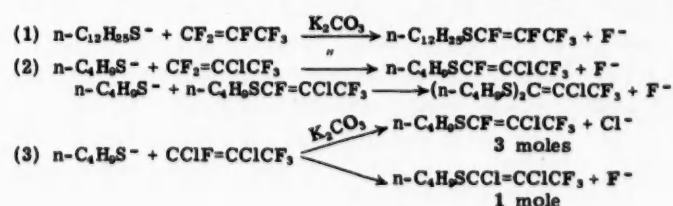
Walter Lee Thompson, Ph.D.
Cornell University, 1955

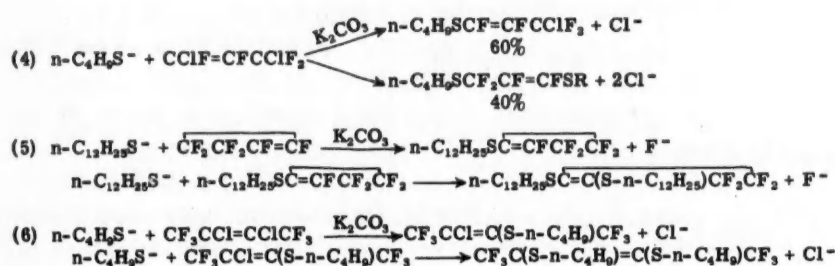
The reactions of the perfluoro and chloroperfluoro-olefins with thiols have been studied under free radical and ionic conditions.

The reactions with thiols were considered of especial interest because thiols have been shown to undergo free radical addition to hydrocarbon olefins including bifunctional systems which yielded high polymers. A few isolated cases of the addition of thiols to chloro and chloro-fluoroolefins by an ionic mechanism had also been reported previously. The well known electrophilic behavior of the fluoroolefins and the marked nucleophilic character of thiols suggested that a wide range of reactions should occur in basic media.

In the present work benzene and n-dodecyl thiols were found to react readily at room temperature with chlorotri-fluoroethylene in the presence of benzoyl peroxide and ultraviolet light to yield simple addition products in almost quantitative yields with the general structure RSCF₂CHClF. Under similar conditions thiols did not add to perfluorobutadiene, perfluoropropene, perfluorocyclobutene, and 4-hydro, 4-chloro, hexafluoro-1-butene. The failure to obtain reaction was attributed to the greater difficulty of attacking these olefins with the RS. radical.

On the other hand a number of chlorofluoropropenes and butenes were found to react quantitatively with thiols in the presence of excess potassium carbonate. Vinyl halogen atoms were replaced stepwise in most cases and the reactions were clean cut. No addition products were isolated under the above conditions. Some typical reactions were:





It was concluded that the vinyl replacement reactions of perhalofluoroolefins with thiols in particular provide methods suitable for the preparation of high polymers with polyfunctional systems. 148 pages. \$1.85. Mic 56-385

THE SYNTHESIS OF 1,2,9-TRIMETHYLPICENE

(Publication No. 15,680)

Donald Edgar Tuites, Ph.D.
Cornell University, 1956

Several structures have been proposed for α -amyrin in the recent literature and, of these, the Jeger formulation has been most widely accepted. If this is correct, it would appear that 1,2,9-trimethylpicene should be a dehydrogenation product of either α -amyrin or one of its derivatives.

The compound, 1,2,9-trimethylpicene has been synthesized from 9,10-dihydrophenanthrene in a 5.5% overall yield. The starting material was condensed in a Friedel-Crafts reaction with methyl allylacetate to give methyl α -(9,10-dihydro-2-phenanthryl) valerate. In a second Friedel-Crafts reaction this ester was condensed with methylsuccinic anhydride to give 2-(1-carbomethoxy-3-butyl)-7-(3-carboxy-1-butanoyl)-9,10-dihydrophenanthrene. Reduction of the keto acid gave 2-(1-carbomethoxy-3-butyl)-7-(3-carboxy-1-butyl)-9,10-dihydrophenanthrene which was aromatized to the phenanthrene derivative in the presence of palladium on charcoal catalyst. This was cyclized to 4-keto-3-methyl-8-(1-carbomethoxy-3-butyl)-1,2,3,4-tetrahydrochrysene which was saponified to the corresponding acid. A Grignard reaction on this keto acid methylmagnesium iodide gave 3,4-dimethyl-4-hydroxy-8-(1-carboxy-3-butyl)-1,2,3,4-tetrahydrochrysene. This was cyclized to 1,2,9-trimethyl-1-hydroxy-12-keto-1,2,3,4,9,10,11,12-octahdropicene which was reduced with lithium aluminum hydride and subsequently aromatized to 1,2,9-trimethylpicene.

The ultraviolet absorption spectrum was very similar to that of authentic 2,9-dimethyl- and 4-methylpicene.

75 pages. \$1.00. Mic 56-386

CHEMISTRY, PHARMACEUTICAL

THIOL ESTERS AND ETHERS OF CYSTEINE

(Publication No. 14,748)

Matthew Verderame, Ph.D.
The University of Wisconsin, 1955

Supervisor: Assistant Professor William O. Foye

Recent discoveries regarding the biological importance of the thiol group of cysteine makes the preparation of thiol esters of cysteine of relative importance. With the exception of N,S-diacetylcysteine, no other thiol esters of cysteine have hitherto been prepared. This research problem was originally begun as a study of the formation and stability of amino acid thiol esters of cysteine, with the hope that they might possess useful pharmacologic activity. In this connection, a number of thiol esters of amino acids with cysteine were prepared. In addition, thiol esters of cysteine with two naturally occurring fatty acids were made.

Recently, however, thiolesterases capable of facilitating the hydrolysis of certain naturally occurring as well as some synthetic thiol esters, including N,S-diacetylcysteine, have been discovered from different mammalian sources. The existence of such enzymes made the in vitro stability study of the thiol esters of cysteine appear inconsequential, and so this aspect of the problem was abandoned. Furthermore, the discovery of thiolesterases prompted us to prepare two halogenated thiol esters and certain ethers of cysteine, in order that they might escape thiolesterase activity and function as antimetabolites.

The acylating and acyl transfer functions of the thiol-containing coenzyme A in fatty acid metabolism have been well established. The thiol esters and ethers of cysteine, prepared in this study, could function as chemotherapeutic agents by blocking, or interfering with, the formation of the S-acyl coenzyme A intermediate or by antagonizing, or obstructing, the acyl transfer function of coenzyme A in fatty acid metabolism.

It has been argued that the thiol ester grouping is capable of existing in the intact protein molecule. To date, however, no evidence has been presented to support this theory. The availability of the amino acid thiol esters of cysteine, prepared in this work, may help to substantiate or refute this theory. It is conceivable that a peptide bond could arise from the interaction of amino acid thiol esters of cysteine and an amino group of an amino acid or peptide. A method of synthesis has therefore been evolved for thiol esters of amino acids with cysteine, which makes possible such a study.

In this work, a new and practical method has been developed for the preparation of N-formylcysteine. In addition, the compound N-carbobenzoxy-L-cysteine has been independently synthesized and characterized for the first time.

A method of preparation of amino acid and fatty acid thiol esters with cysteine has been evolved. The amino group of cysteine was protected either with the formyl blocking group, as L-formylcysteine, or with the carbobenzoxy group, as N-carbobenzoxy-L-cysteine. Some of the substituted thiol esters were prepared by the use of a two-phase system, consisting of water and a water-insoluble solvent. Others were prepared in an anhydrous

medium. Attempts to remove the formyl group by the hydrolysis of the intermediate thiol ester compounds failed. The thiol ester grouping, however, was observed to be stable under those conditions which effected the removal of the carbobenzoxy group from the N-substituted amino acid derivatives.

The phthaloyl group was employed to block the amino group of glycine for the synthesis of S-(N'-phthaloylglycyl)-N-formyl-L-cysteine. Attempts to remove it by the conventional procedures, using hydrazine and phenylhydrazine, led to the complete destruction of the thiol ester compound.

A method has also been developed for the S-alkylation of the cysteine base. No contamination by N- or O-alkylated products was detected. This involved a two-phase system employing alkyl halides in the presence of triethylamine.

The following thiol esters and ethers of cysteine were prepared in this study.

S-(N'-Phthaloylglycyl)-N-formyl-L-cysteine
 S-(Glycyl)-N-formyl-L-cysteine hydrobromide
 S-(DL-Phenylalanyl)-N-formyl-L-cysteine hydrobromide
 S-(α -Alanyl)-N-formyl-L-cysteine hydrobromide
 S-(Glycyl)-L-cysteine dihydrobromide
 S-(DL-Phenylalanyl)-L-cysteine dihydrobromide
 S-(α -Alanyl)-L-cysteine dihydrobromide
 S-(Lauroyl)-L-cysteine hydrobromide
 S-(Myristoyl)-L-cysteine hydrobromide
 S-(Chloroacetyl)-L-cysteine hydrochloride
 S-(Trichloroacetyl)-L-cysteine hydrochloride
 S-(Carboxymethyl)-L-cysteine
 S-(1-Carboxyethyl)-L-cysteine
 S-Ethyl-L-cysteine
 S-Isopropyl-L-cysteine

108 pages. \$1.35. Mic 56-387

CHEMISTRY, PHYSICAL

STUDIES IN MOLECULAR STRUCTURE

(Publication No. 13,905)

Jonathan W. Amy, Ph.D.
 Purdue University, 1955

Major Professor: Walter F. Edgell

The Microwave Rotational Spectrum of $\text{CF}_3\text{CH}_2\text{D}$

Microwave absorption frequencies for $\text{CF}_3\text{CH}_2\text{D}$ and CF_3CH_3 have been measured in the region from 17 to 30 kmcs. The observed frequencies have been assigned to various transitions and three moments of inertia have been calculated. Using these moments, a structure for CF_3CH_3 has been determined.

The Microwave Rotational Spectrum of $\text{CF}_2 = \text{CH}_2$

Microwave absorption frequencies for $\text{CF}_2 = \text{CH}_2$ have been accurately measured for the region from 17 to 30 kmcs. Three moments of inertia have been calculated using this data and a structure consistent with these moments has been found.

The Microwave Rotational Spectrum of CF_3CN

The microwave spectrum of CF_3CN has been measured in the region from 17 to 36 kmcs. Assignments have been made for the lines observed to ground state and excited vibrational state transitions. A value for B_0 has been calculated.

The Purdue Microwave Spectrometer

A complete description and operating instructions are given for the Purdue microwave spectrometer.

143 pages. \$1.79. Mic 56-388

STUDIES ON ELECTROLYTES: A. THE EFFECT OF PRESSURE ON THE TRANSFERENCE NUMBERS OF SIMPLE ELECTROLYTES. B. NUMERICAL SOLUTION TO THE POISSON-BOLTZMANN EQUATION FOR SPHERICAL POLYELECTROLYTE MOLECULES.

(Publication No. 15,187)

Joan Berkowitz, Ph.D.
 University of Illinois, 1955

Part A

A moving boundary method was used to determine cation transference numbers in 0.02 N aqueous solutions of KCl, KBr, NH_4Cl , NaCl at pressures of 1, 500, and 1000 atmospheres. The velocity of the boundary was determined from the change in resistance as a cadmium halide following solution moved up the cell. An approximately linear decline in cation transport number was observed in the chloride solutions. The magnitude of the decline was about 2% for the KCl and NH_4Cl solutions and almost 3% for the NaCl solution for the pressure range investigated. The K^+ transference number in KBr showed a 1% drop in the first 500 atmospheres, but none in the next 500. Comparison with previous work on 0.1 N solutions of KCl and NaCl indicates that the rate of decrease in cation transference number with pressures is independent of concentration.

Part B

A completely penetrable sphere which is initially assumed to be uniformly charged throughout its volume is chosen as a model of a polyelectrolyte molecule. The macro-ion is considered, first, in a large volume of a solution of a uni-univalent electrolyte and then, in a pure ionizing solvent with no added salts. For each of these environments, a Poisson-Boltzmann equation is set up for the potential in and about the polyion. For polymers of various sizes and initial charge densities, the Runge-Kutta method was used to solve the equations numerically with the aid of the University of Illinois digital computer. From the tabular results, the net fraction of counter ions that would penetrate the volume of the polymer was calculated. The "bound" fraction was found to vary between 0.30 and 0.80 for practical values of the parameters. This is in good agreement with experiment.

183 pages. \$2.29. Mic 56-389

THE CRYSTAL STRUCTURE OF SILVER PERFLUOROBUTYRATE

(Publication No. 15,513)

A. Eugene Blakeslee, Ph.D.
Cornell University, 1955

Silver perfluorobutyrate exhibits the interesting property of being very soluble both in water and in benzene, as well as most other common solvents except aliphatic hydrocarbons. It normally crystallizes in the form of very thin plates which are difficult to handle because of their extreme softness, which is attributed to strong thermal lattice vibrations. Narrow segments were cut from the plates parallel to the *a* and *b* axes and used for x-ray diffraction examination.

Lattice constants found for the monoclinic crystal are the following: *a* = 6.46 Å; *b* = 9.01 Å; *c* = 13.1 Å; β = 100.2°. There are four molecules of $\text{AgC}_4\text{F}_7\text{O}_2$ per unit cell, and the space group, as verified by the structure determination, is $C2_{2v}-C_2^3$.

Intensity measurements were carried out with a Geiger counter x-ray spectrometer using Mo $K\alpha$ radiation. Only zero layer reflections were measured because the specimens obtained were not perfect single crystals, causing higher layer diffraction maxima to be highly distorted. Seventy distinct (*Ok* ℓ) forms and 99 (*hO* ℓ) forms were recorded. Approximate absorption corrections were applied.

By Patterson projections along (100) and (010) the Ag atoms were located in the unit cell. The centrosymmetric (010) Fourier projection, with Ag totally in phase for every reflection, gave approximate *x* and *z* parameters for the light atoms. These *z* parameters, plus *y* values obtained by constructing a scale model of the molecule, were used to calculate phase angles for the non-centrosymmetric (100) projection. Anisotropic temperature factors based on the observed anisotropic falling-off of intensities with $\frac{\sin \theta}{\lambda}$ were included in the phase angle calculations. Complete refinement of the (100) projection was impossible because carbon atom peaks were not resolved and the extremely high thermal motion caused the other light atom maxima to be diffuse.

The fairly accurate Ag positions and approximate light atom positions found show that pairs of $\text{AgC}_4\text{F}_7\text{O}_2$ molecules form more or less linear dimers in the crystalline state. At the center of the dimer is an eight-membered silver-oxygen-carbon ring with the two Ag's lying on the two-fold rotation axis. Such dimerization accounts for the solubility of the compound in benzene.

The Ag—Ag distance in the dimer was found to be $2.90 \pm .02$ Å, nearly identical to that in metallic silver and much shorter than what is observed in most silver compounds. Although no exact quantitative statements can be made about other individual bond distances, there is considerable evidence that the average C—F bond in this structure must be shortened to nearly 1.30 Å.

58 pages. \$1.00. Mic 56-390

THE EFFECT OF A MAGNETIC FIELD ON THE ELECTROMOTIVE FORCE OF A GALVANIC CELL

(Publication No. 15,650)

Glenn Eldon Brand, Ph.D.
State College of Washington, 1955

This investigation dealt with the effect of a magnetic field on the electromotive force of a galvanic cell. A study of the reactions taking place in a cell consisting of two identical reversible electrodes located in magnetic fields of different strengths indicated that a difference in chemical potential existed. Therefore, an electromotive force between them should be observed. The effects of gravity and a magnetic field on the electromotive force were compared.

An equation was derived which expressed the electromotive force produced as a function of the strength of the magnetic field, magnetic susceptibility, and transference number. This equation shows that this electromotive force results from the attraction of the magnetic field for the paramagnetic ions and from the PV work involved. The equation shows that the forces between the magnetic field and diamagnetic substances are too small to produce a detectable electromotive force.

The equation was then tested experimentally. Since the magnitude of the electromotive force measured was only a few tenths of a microvolt, and a high degree of precision was desired, the proper design of the equipment was a major part of the investigation. The cell consisted of an electrolyte containing a positive paramagnetic ion and two identical calomel electrodes.

Since preliminary measurements indicated that variations in temperature of more than a few hundred thousandths of a degree would introduce appreciable errors, the use of a permanent magnet was advisable. The cell was placed in an aluminum block between the pole pieces of a large permanent magnet. This provided a large heat reservoir which maintained an almost constant temperature in the interior of the aluminum block. This assembly was placed in a water tight lucite box and immersed in a large water bath.

The electrodes were alternately placed in the strong magnetic field and measurements of the electromotive force made. This small electromotive force was measured with a potentiometer in which it was balanced by varying the resistance. An extremely sensitive Paschen type galvanometer was used for the balancing operation.

The results, within the limits of accuracy, demonstrated the correctness of the derived formula.

Measurements were also made on cells which contained only diamagnetic substances. The electromotive force produced by the magnetic field in these cells was zero within the accuracy of the experiment.

51 pages. \$1.00. Mic 56-391

A QUANTUM MECHANICAL STUDY OF THE INDUCTIVE EFFECT

(Publication No. 13,913)

Joseph Michael Cahill, Ph.D.
Purdue University, 1955

Major Professor: Charles R. Mueller

The increased acidity of ClCH_2COOH over CH_3COOH is a common example of the inductive effect in operation. In this paper, the inductive effect is defined as any electronic displacement in a bond due to intramolecular environment. The model employed to study the effect is a CH_3CHO molecule with the hydrogen atoms stripped off, referred to as the acetaldehyde group, or $\text{CC}'\text{O}$. The isolated carbonyl group is denoted as $\text{C}=\text{O}$ and the system $\text{C}-\text{C}'$ is composed of tetrahedrally and trigonally hybridized carbon atoms.

Calculation and comparison of the dipole moments of bonds in $\text{C}=\text{O}$ and $\text{C}-\text{C}'$ with similar bonds in $\text{CC}'\text{O}$ serve as a means of studying the inductive effect. The dipole moment of a bond, μ_{AB} , is given by $(\psi_{AB}/\vec{r}/\psi_{AB})$. The bond eigenfunction, ψ_{AB} , here is described using one electron semi-localized orbitals which are formed from the Slater-type atomic orbitals, a and b on the bonded atoms.

The energy for the system is expressed using the Dirac vector method. The Hamiltonian, H , is the two electron one, including coulomb repulsions from electrons not involved in the bond, but with nuclear repulsion omitted. Considering ϕ_2 , the second of the two bonding orbitals as known, ϕ_1 is written as a linear combination of the atomic orbitals forming it and substituted into the energy expression. Differentiation with respect to the coefficients yields two simultaneous linear equations equalling zero according to the Variational Principle. The condition that these secular equations have a nontrivial solution takes the form of a secular determinant, $|C_{ab}| = 0$, with matrix elements

$$C_{ab} = (ab/H/\phi_2\phi_2) + \sum_{n \geq 2} c_{1n}(a\phi_n/H/o\phi_n) \\ - E \{ S(a,b) + \sum_{n \geq 2} c_{1n} S(a,\phi_n)S(b,\phi_n) \}.$$

Repeated solution of the secular equations for the bonding orbitals relative to one another leads to a self-consistent field.

The π -bond of $\text{C}=\text{O}$ is considered as formed from electrons originally in the $2p_y$ orbitals of oxygen and carbon, y_o and y_c ; the σ -bond formed from z_o and t_1 , a trigonally hybridized orbital. Application of the method discussed leads to a self-consistent set of orbitals, $Y_c = y_c + 2.850y_o$, $Y_o = y_o - 0.005y_c$, $T_1 = t_1 - 0.074z_o$, and $Z_o = z_o + 6.023t_1$. The dipole moments are $\mu_\pi = 5.00 \text{ D C}^+ \text{ O}^-$ and $\mu_\sigma = 1.32 \text{ D C}^- \text{ O}^+$.

The self-consistent orbitals in $\text{C}-\text{C}'$ take the form of heteropolar molecular orbitals, $\text{Tr}_1 = \text{Te}_1 = \text{te}_1 + 1.096\text{tr}_1$ and μ_{cc} is $0.14 \text{ D te}^+ \text{ tr}^-$.

The three-center problem is approached by dividing the Hamiltonian, H'' , into that for the isolated two center case and a perturbation due to the added third atom. The perturbation Hamiltonian is further divided into two parts, corresponding to a field effect and a bond effect. The dipole moments in the double bond remain practically constant under the bond perturbation and the sum of the bond

and the field. The $\text{C}-\text{C}'$ dipole decreases to 0.11 D under the influence of the bond effect alone. Addition of the field effect, however, brings the moment up to 0.35 D .

The results point to a field mechanism for the inductive effect and support of an increased dipole in the three center case by $\text{C}-\text{C}'$, not $\text{C}=\text{O}$.

185 pages. \$2.31. Mic 56-392

KINETICS AND MECHANISM OF THE THERMAL DECOMPOSITION OF AMINE NITRATES, AND THE VIBRATIONAL SPECTRUM OF METHYL NITRATE:

I. THE VIBRATIONAL SPECTRUM OF METHYL NITRATE.

II. KINETICS AND MECHANISM OF THE THERMAL DECOMPOSITION OF AMMONIUM NITRATE.

III. THE THERMAL DECOMPOSITION OF PRIMARY ALIPHATIC AMINE NITRATES.

(Publication No. 13,675)

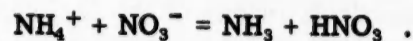
Thomas Mack Cawthon, Jr., Ph.D.
Princeton University, 1955

The infrared absorption of methyl nitrate in the vapor and liquid phase has been measured in the range $2-15 \mu$ and frequencies have been assigned to all the fundamental vibrations except the two torsional modes. The characteristic frequencies of the $-\text{ONO}_2$ group are at $1672 (\text{vs})$, $1287 (\text{s})$, $854 (\text{s})$, $759 (\text{m})$, $657 (\text{m})$ and $578 (\text{m}) \text{ cm}^{-1}$. The heat capacity ($C_p = 16.2 \text{ cal mole}^{-1}$) and entropy ($S_{298.2}^0 = 75.97 \text{ e.u.}$) of methyl nitrate vapor have been calculated assuming free internal rotation. Comparison of the statistical and thermal entropies indicates that the barriers hindering internal rotation are small, and the infrared band contours and Raman depolarization factors are interpreted assuming free rotation about the $\text{O}-\text{N}$ bond.

The rate of thermal decomposition of ammonium nitrate has been determined as a function of temperature and the amount of ammonium nitrate decomposing. These data are expressed by the equation:

$$d\text{N}_2\text{O}/dt = k [\text{NH}_4\text{NO}_3] \text{ in which } k = 5.62 \times 10^{12} e^{-\frac{39.9}{RT}} \text{ sec}^{-1}.$$

Kinetics of the decomposition reaction, determined by the dependence of the decomposition rate on the concentration of ammonium nitrate in mixed nitrate melts, are consistent with a mechanism which involves as the rate controlling step, reaction of ammonia with hydrated nitronium ion to give nitramide. According to this mechanism, the energy of activation for the thermal decomposition of ammonium nitrate is due largely to the endothermicity of the reaction:



The rate of methyl ammonium nitrate decomposition is proportional to the amount of methyl ammonium nitrate decomposing, and initial first order rate constants for the formation of nitrogen are expressed by the Arrhenius equation: $k = 1.45 \times 10^9 \exp(-30,000/RT) \text{ sec}^{-1}$. A mechanism for the decomposition of methyl ammonium nitrate is proposed. This mechanism involves as the slow step, reaction of methyl amine with hydrated nitronium ion to give methyl nitramine, and methyl nitramine is assumed to decompose rapidly to give either nitrous oxide or nitrite ion as one of the products.

The rate of nitrogen formation in the thermal decomposition of tertiary butyl ammonium nitrate has been determined as a function of temperature and the amount of tertiary butyl ammonium nitrate decomposing and expressed by the equation:

$$\frac{dN_2}{dt} = 6.46 \times 10^{14} e^{-\frac{43,600}{RT}} [C_4H_9NH_3NO_3] \text{ mole sec}^{-1}$$

A mechanism analogous to the methyl ammonium nitrate mechanism is proposed for the thermal decomposition of tertiary butyl ammonium nitrate. A general mechanism which is consistent with the decomposition kinetics and observed volatile products from methyl ammonium nitrate, tertiary butyl ammonium nitrate, iso butyl ammonium nitrate, trifluoro ethyl ammonium nitrate and dimethyl ammonium nitrate, is proposed for the thermal decomposition of primary aliphatic amine nitrates.

108 pages. \$1.35. Mic 56-393

THE SONIC DETERMINATION OF PARTICLE SIZE IN AEROSOLS

(Publication No. 14,651)

George Joseph Patrick Doyle, Ph.D.
Indiana University, 1955

The dependence of displacement amplitude on radius was experimentally investigated for spherical droplets in a standing sound wave in nitrogen. The research was oriented towards possible application of this effect to the determination of particle size in aerosols.

The apparatus consisted of a rectangular cell 1.59 mm. by 12.7 mm. in cross section fitted with thin glass windows for observation. One end of the cell contained a movable reflector to allow adjustment of the standing wave pattern so that a displacement antinode could be brought in front of the windows. The other end of the cell was coupled by means of a tapered rectangular horn to an electromagnetically driven duraluminum bar vibrating in its fundamental longitudinal mode at 4.85 kc./sec. The vibrating droplets were photomicrographed at a magnification of 70X for an exposure lasting 10 or more periods of the sound.

Aerosols were generated from di-2-ethyl-butyrate triethylene glycol and bis-2-ethyl-hexyl phthalate in a modified La Mer-Sinclair aerosol generator. The chief modifications consisted of: (1) The use of a downward flow in the cooling chimney to accommodate large particle sizes; (2) Automatic control of the temperature of the evaporating liquid, using a thermocouple as the sensing element, in order to obtain extreme stability with time.

Particle size distributions of the generated aerosols were obtained by taking photomicrographs of the falling droplets during precisely measured exposure times. The temperature gradients and associated convection currents within the observation cell for these rate-of-fall measurements were made negligible by immersion of the cell in a stirred thermally isolated water bath.

Each experiment consisted of a set of amplitude measurements bracketed chronologically by two sets of rate-of-fall measurements. Only those experiments for which the two sets of measurements of particle size distribution were statistically compatible within 95% confidence regions were

taken as significant. All experiments were done with a sound displacement amplitude of 50 microns in nitrogen at 25° C. and 1 atmosphere. The range of rapid variation of amplitude with droplet radius, about 0.8 to 3.9 microns for a droplet density of 0.993 gm./cc., was covered in 11 acceptable experiments. The results agreed with theoretical amplitudes calculated by means of an expression derived by C. J. T. Sewell (Phil. Trans. Roy. Soc. (London), 210A, 239-270 (1910); see also H. Lamb, "Hydrodynamics," 6th ed., Dover Publications, New York, 1945, pp. 659-661). The ratios of particle amplitude to sound displacement amplitude scattered about the theoretical amplitude ratios with a standard deviation of 0.07 which was within estimated experimental accuracy.

182 pages. \$2.28. Mic 56-394

PHASE STUDIES OF THE TWO-COMPONENT CARBON DIOXIDE-WATER SYSTEM INVOLVING THE CARBON DIOXIDE HYDRATE

(Publication No. 15,235)

Sager Daryl Larson, Ph.D.
University of Illinois, 1955

The recent interest in gas hydrates in this laboratory has called attention to the hydrate of carbon dioxide which is of considerable interest for several reasons. One of these is the possible role of the hydrate in the atmosphere in the formation of snow crystals. Another is the possibility of making use of this hydrate or other hydrates in the separation of fresh water from sea water.

Since there were no recent studies and the data available are uncertain in degree of accuracy, it seemed desirable to make a new study of the carbon dioxide-water system. The decomposition pressures of the hydrate when dissociating into liquid water and gaseous carbon dioxide and into ice and gaseous carbon dioxide were measured and the corresponding heats of decomposition calculated. For the hydrate-liquid water-gaseous carbon dioxide equilibrium the enthalpy change was found to be 14.4 kilocalories; for the hydrate-ice-gaseous carbon dioxide equilibrium, a value of 5.68 kilocalories was obtained.

From this data it is possible to make a thermodynamic calculation of the composition of the hydrate. The determination of the composition of the hydrate of carbon dioxide has been the object of several investigations in the past but the results have been inconclusive. None of these studies have, however, attacked this particular problem through the use of thermodynamic relationships although the method has been used with other gas hydrates. By this method the carbon dioxide hydrate is found to contain six water molecules.

A study of the decomposition pressures of the hydrate formed from acid, base, and salt solutions of several different concentrations showed that the decomposition pressure increases as the concentration of the solution increases, it being independent, however, of the particular solute present. This result added supporting evidence to the theory of hydrate formation that had been previously proposed in which a more ordered open ice-like lattice is formed as the hydrating molecule enters the water and the neighboring water molecules retreat from their original

positions and take up new positions encasing the hydrating molecule.

By the application of the phase rule diagram that was drawn from the pressure-temperature measurements made in this investigation, it doesn't appear possible for the carbon dioxide hydrate to play a role in the formation of snow crystals in the atmosphere. The decomposition pressure is apparently too high for the hydrate to exist. Similarly, under natural conditions it would not be possible for the hydrate to exist in sea water. However, evidence is given showing the hydrate can be formed in sea water under sufficient pressure of the hydrating molecule. This fact might lead to a method by which fresh water could be obtained from sea water.

A possible explanation for the seemingly negligible decomposition pressure exhibited by the clathrate compounds was found. It appears that a true equilibrium is not established between the clathrate compound and its dissociation products. 88 pages. \$1.10. Mic 56-395

A STUDY OF "INERT" INDICATING ELECTRODES IN STRONG OXIDIZING AQUEOUS SOLUTIONS

(Publication No. 15,647)

Jung Kong Lee, Ph.D.
Princeton University, 1955

The earliest attempt of measuring redox potentials with a noble metal indicating electrode was made by Bancroft. Since then, gold and platinum have been the most commonly used metals for the potential measurements of redox systems. It is generally believed that the metal indicating electrode must be "inert" in the particular solution in order to measure the potential of the solution. The metal is said to be "inert" when it is non-oxidizable in the solution. If a comparison of the formal potentials of the commonly employed oxidants, such as ceric, permanganate, bromate etc., with the potentials of oxide formation of the noble metals is made, one can readily see that it is entirely possible for oxides to be formed on gold and platinum surfaces when these metals are in contact with the above mentioned oxidants. This seems to contradict the commonly accepted concept that the indicating electrode must be "inert." The main object of this work is to investigate whether the metals which are commonly used as indicating electrodes are truly "inert" when in contact with strong oxidants.

With no claim of originality, the results of the present work showed that oxides were formed on the surfaces of noble metal electrodes when anodically oxidized. In the case of gold, Au_2O , AuO , and Au_2O_3 were formed stepwise. In the case of platinum, PtO and PtO_2 were observed when the current density used was low. At higher current densities, the two steps became inseparable. In the case of palladium, the formation of PdO and PdO_2 were observed as two distinct steps. The results of the anodic oxidation presented in the form of potential-time curves were compared with the findings of the chemical oxidation of the noble metals using strong oxidants (i.e. ceric, permanganate etc.). The potential-time curves obtained from the chemical oxidations of the noble metals were similar to those obtained in the anodic oxidations. When the reduction

potential of the oxidants were high (positive) enough, all of the oxide formation steps were observed. It was concluded that indicating electrodes made of gold, platinum and palladium were not "inert" in strong oxidizing aqueous solutions.

The chemical oxidation of gold, platinum and palladium in chloride solution was also studied. The results showed that while platinum became passive quickly by virtue of oxide formation on the surface, gold and palladium dissolved continuously but slowly.

From the results of the present work, and the fact that the potential of a metal electrode in a non-oxidizing solution (e.g. potassium chloride) depends on the oxide on its surface, it is logical to conclude that the indicating electrode indicates the potential of the oxidizing solution via a mechanism of oxide formation on its surface.

The oxide mechanism of potential indication in strong oxidizing solution was applied to explain the working mechanism of the well known "bimetallic systems" used in the end point indications of potentiometric titrations. The difference in the electrode behaviour shown by different metals or the same metal with different pre-treatment can be explained by the chemical reaction on the surfaces of the electrodes. 117 pages. \$1.46. Mic 56-396

A STUDY OF THE CONTACT POTENTIALS OF EVAPORATED METAL FILMS BY A DYNAMIC CONDENSER METHOD: THE EFFECTS OF OXYGEN AND HYDROGEN ON SILVER, COPPER, AND ALUMINUM FILMS

(Publication No. 15,525)

Howard Leonard Recht, Ph.D.
Cornell University, 1955

Our understanding of the processes which occur in heterogeneous catalysis is being advanced by investigations of the contact potential properties of the catalyst-adsorbate complexes. Several contemporary theories of catalysis were reviewed to demonstrate their diversity and lack of completeness. It is plausible that these could be correlated into a unified picture by a study of the fundamental properties which account for the presence of a contact potential.

A thermodynamic derivation of the contact potential and of related quantities is given, and the nature of the changes in the contact potential with temperature and with change in the surface density of dipole moment are presented. Other methods, beside the contact potential, which are available for determination of the work function of a surface are listed; their advantages and drawbacks for application to a study of the catalyst-adsorbate complex are then enumerated. The introductory section is completed with a review of related contact potential studies. A general discussion of the mode of function of dynamic condenser electrometers follows, and typical examples of the dynamic condenser method of contact potential measurement are cited. The design features which are significant for contact potential measurements are indicated.

In these experiments a new design for a dynamic condenser was utilized. The unit consisted of two concentric cylinders slotted lengthwise for most of their length. The

inner cylinder was stationary, while the outer one rotated producing the needed variation of capacitance. Details of construction are given. Motive power was provided by driving two iron bars fastened to the dynamic condenser rotor with external magnets.

The potential developed was measured by an amplifier, synchronous rectifier, and a recording oscillograph. The synchronizing signal was generated by an interrupted light beam reflected by the slotted rotor, to a phototube-amplifier circuit. The system was calibrated by an additional circuit utilizing a voltage impressed across a variable resistor. The hydrogen used for study was purified by diffusion through a heated palladium tube. The reaction tube was heated by an externally wound asbestos covered nichrome wire. Details of the procedures for evaporation of the metal films, calibration, and adsorption of a gas are also given. A summary of development is presented to indicate the major pitfalls and limitations of the present unit. Suggestions are made for improvements.

Preliminary values of the contact potential between aluminum (evaporated film) and aluminum alloy (24ST3), and of copper and aluminum alloy are reported. These results indicated no effect on the contact potential of copper upon the introduction of oxygen, hydrogen, or ethylene. On an evaporated silver surface, oxygen induced a rise in the contact potential over an interval estimated as being less than one second. A series of measurements indicated a reduction in this value when the system was heated to 100°C with hydrogen. The change was not reversed on re-treatment with oxygen.

Short-period phenomena were observed with oxygen, hydrogen, and ethylene on both copper and silver surfaces. Upon admission of the gas at a pressure of 10 mm of Hg, the contact potential rose and then fell to approximately the initial value within two to four seconds; this was termed a "regular" effect. If the contact potential fell and then rose, it was termed "anti-regular." On copper only the regular effect was noted. On silver, oxygen on a clean surface gave an anti-regular effect, while hydrogen and ethylene after this gave a regular effect. An analysis of possible errors and an estimate of the accuracy of the reported values are also presented.

On the basis of additional hypotheses, preliminary calculations were made of the surface dipole moment per adsorbed oxygen atom, and of the energy of activation for oxygen adsorption. A listing of the results reported by other workers shows much inconsistency in the reported data, indicating the need for further work. An explanation for the short-period phenomena is outlined.

89 pages. \$1.11. Mic 56-397

THE CRYSTAL STRUCTURE OF BORON

(Publication No. 15,503)

Donald Edgar Sands, Ph.D.
Cornell University, 1955

The crystal structure of the plate-like modification of elementary boron was investigated by means of X-ray diffraction. The lattice geometry was determined from oscillation and Weissenberg photographs of a single crystal, revealing a tetragonal unit cell identical with that

reported by Hughes for the needle-like modification. The unit cell dimensions found for the crystal studied were $a = 8.77$, $c = 5.09$ Å. The space group decided on was $D_{4h}^{12} - P4_2/nm$. However, very weak reflections inconsistent with this space group were observed. Multiple scattering was considered as a possible source of these forbidden reflections, and it was found that they could all be explained on this basis.

Complete intensity data were obtained with the aid of a Geiger counter spectrometer, especially adapted for single crystal work. A convergent beam technique was used for these measurements, and the instrument was equipped with a vertical arc to facilitate complete coverage of the reciprocal lattice.

The ideal structure derived by Hughes was confirmed by Fourier projections of the electron density onto the (001) and (100) planes, the (xxz) section, and the bounded projection between $x = 0$ and $x = a/4$. The unit cell of this ideal structure contains fifty atoms, forty-eight arranged at the vertices of four nearly regular icosahedra centered at $\frac{1}{4}, \frac{1}{4}, \frac{1}{4}$; $\frac{3}{4}, \frac{1}{4}, \frac{3}{4}$; $\frac{3}{4}, \frac{3}{4}, \frac{1}{4}$; and $\frac{1}{4}, \frac{3}{4}, \frac{3}{4}$. The icosahedra are linked through the two remaining atoms which occupy the special positions $0, 0, \frac{1}{2}$; $\frac{1}{2}, \frac{1}{2}, 0$.

The projections displayed small peaks at other special positions, interpreted as being due to occasional extra atoms in the lattice at these sites. In addition, the section and the bounded projection exhibited numerous anomalous peaks and areas of high electron density. These were qualitatively interpreted as presenting evidence for the existence of serious defects in the crystal.

An artificial isotropic temperature factor was computed, giving $B = 1.04$. The value of R , a reliability coefficient, was 0.158, on the basis of omitting all unobserved reflections. This seemed to adequately confirm the overall validity of the structure.

Values for the boron-boron bond length computed for this crystal ranged from 1.72 to 1.89 Å (with an average of 1.83 Å) for the bonds within an icosahedron, 1.65 and 1.68 Å for the bonds joining atoms of different icosahedra, and 1.64 Å for the tetrahedral bond. These bond distances are in good agreement with the values reported for compounds of boron.

104 pages. \$1.30. Mic 56-398

A STUDY OF THE DIFFUSION IN WATER SOLUTION OF THE WEAK POLYELECTROLYTE, CARBOXYMETHYL AMYLOSE: THE EFFECTS OF CONCENTRATION AND OF THE DEGREE OF SUBSTITUTION

(Publication No. 15,642)

Anthony Gray Scott, Ph.D.
Columbia University, 1954

Several polycarboxylic acids were prepared by the carboxymethylation¹ of the linear polymeric component of potato starch called amylose. The derivatives studied in the present work had the following average degrees of substitution; 0.58, 0.13 and 0.03, where degree of substitution is defined as the average number of carboxyl groups per monomer unit.

The diffusion of these substances was studied using the Lamm scale refractometric method of observation.

Sedimentation velocity measurements were also made as an independent means of observing the boundary patterns obtained in diffusion. In addition, the reduced viscosity was studied as a function of concentration in water solution. Several diffusion and sedimentation runs were made in neutral salt solution to observe the behavior when charge effects are diminished.

The concentration dependence of the diffusion coefficient was analyzed in terms of the Boltzmann equation for the diffusion coefficient using the methods developed by Beckmann and Rosenberg.

The magnitude of the weight average diffusion coefficient in water solution was much greater than that expected for an uncharged polymer of equivalent size and shape. This is due to the effect of the diffusion potential arising from the large difference in mobility between the polyions and their counterions. The magnitude of the diffusion coefficient was found to decrease with a decreasing number of ionizable substituents on the polymer. The shape of the diffusion curves deviated strongly from that observed for uncharged polymers. For each derivative studied these curves were characterized by a shoulder or second maximum on the solvent side of the boundary. The shoulder moved into the solvent a distance proportional to the square root of time. In the presence of neutral salt the diffusion curves were similar to those obtained for uncharged polymers.

Applying the Boltzmann equation to the normalized diffusion curves gave the following results. For the more highly substituted materials the diffusion coefficient increased with decreasing concentration reaching a maximum value in the range 0.1 to 0.2 weight per cent concentration. With a further decrease in concentration the diffusion coefficient dropped off rapidly reaching a value equivalent to that at the original concentration in the region of 0.05 weight per cent concentration. At higher concentrations the diffusion coefficient of the 0.03 derivative remained constant with decreasing concentration while in the region of 0.5 to 0.3 weight per cent concentration the diffusion coefficient began to decrease steadily as the concentration went to zero.

These results are best understood in the light of the thermodynamic and hydrodynamic terms of the Onsager-Fuoss equation for the diffusion coefficient. For a weak polyelectrolyte in water solution both these terms may be expected to increase with decreasing concentration due to the increase in the degree of ionization with decreasing concentration. Thus, for the 0.58 and 0.13 derivatives the thermodynamic effects outweigh the frictional effects at higher concentrations and the diffusion coefficient increases with decreasing concentration. At lower concentrations the particles are extended by the intramolecular electrostatic interactions between adjacent charged groups on the polymer and the frictional effects begin to outweigh those of the thermodynamic term and the diffusion coefficient decreases. For the 0.03 derivative the two terms balance one another at higher concentrations while at lower concentrations the hydrodynamic factor controls the diffusion as in the case of the more highly substituted materials. The presence of the shoulder may be attributed to this behavior of the diffusion coefficient as a function of the concentration. 108 pages. \$1.35. Mic 56-399

1. M. Roger, Dissertation, Columbia University, New York, N. Y. (1952).

THE REACTION OF FORMALDEHYDE WITH CELLULOSIC FIBERS

(Publication No. 13,742)

Henry Kyi-oen Woo, Ph.D.
Princeton University, 1955

The formaldehyde-cellulose reaction under acidic conditions and elevated temperatures is generally conceded to lead to the formation of methylene ether bridges between adjacent cellulose chains. This study is concerned with two important but relatively less extensively explored phases of the cross-linking reaction, namely: (1) the rate and mechanism of the reaction considered in the light of the state of internal order of cellulosic materials, and (2) the effects of cross-linking on the mechanical behavior of the cellulosic materials as manifested in single fibers, yarns, and fabrics.

The reaction was carried out on the materials in the fabric form. Three different varieties of cellulose representing three distinctive types of state of internal order were used, viz., cotton, Fortisan, and viscose rayon. Experiments were made with variations of three initial pH's, 2.0, 2.2, 2.4; three initial concentrations of formaldehyde applied, 2.5, 5.0, 7.5% for Fortisan and rayon, and 5.0, 7.5, 10.0% for cotton; three baking temperatures, 110°, 120°, 130° C.; and four baking periods, 5, 10, 15, 30 minutes for each set of reaction conditions.

For all the three materials, at initial pH of 2.2 and 2.4, the reaction appeared to take place in the amorphous regions only. The activation energy was 14-17 kcals/mole. At pH 2.0, the rate plots indicated a considerable amount of very rapid reaction in the amorphous regions, followed by further reaction in the same regions, and finally some reaction occurred in the crystalline regions. The rate-controlling step appeared to be one of diffusion of formaldehyde molecules to the hydroxyls in the crystalline regions. The activation energy was 4-7 kcals/mole.

As regards the rate and extent of reaction, cotton reacted the slowest and to the least extent, Fortisan and rayon reacted to about the same extent, with Fortisan having a higher rate. Plausible explanations are that the higher orientation of the chain molecules in Fortisan probably facilitates the cross-linking process, and that rayon possibly has a higher rate of recrystallization during acid hydrolysis which retards further cross-linking.

X-ray diffraction patterns of the materials treated at initial pH's 2.0 and 2.2 were compared with those of the original samples and samples treated under the same conditions with acid solutions of the same pH's containing no formaldehyde. Results seemed to support the proposed reaction mechanisms.

Mechanical behavior studies were made on materials treated under a selected set of optimum conditions. They were compared with "blank" controls and "acid" controls treated under the same conditions. The data on single fibers indicated that the loss in tensile strength, generally observed with the acid-formaldehyde treatment, was mainly due to the hydrolytic degradation that inevitably accompanied the cross-linking reaction. Cross-linking in native cellulose resulted in a further decrease in tensile strength as compared to the acid degraded sample, while in regenerated cellulose fibers, viscose rayon, and Fortisan, a significant gain in strength was observed. The overall loss in strength was serious in the case of cotton and

Fortisan but very slight in rayon. The latter, however, suffered a greater loss in extensibility and its stress-strain curve was marked by the absence of a prominent yield point.

The results obtained with yarns and fabrics (one-dimensional testing) were very much the same as those obtained with single fibers. A new device, the Two-Dimensional Load-Elongation tester, was also used in fabric testing. Formaldehyde-treated rayon fabric was found to have a higher Asymmetry Index which was interpreted as the expected result of increased intermolecular cohesion through cross-linking in the molecular network of the fiber. An Asymmetry Energy Ratio was defined in an effort to compare the results of the conventional one-dimensional testing with those of the two-dimensional testing.

Wrinkle recovery tests carried out on all the treated fabrics showed that a marked improvement in wrinkle recovery was obtained only with those treated at an initial pH of 2.0, indicating that a nearly complete cross-linking of the hydroxyls in the amorphous regions was necessary to effect higher wrinkle recoverability.

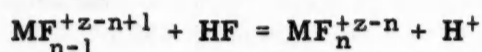
154 pages. \$1.93. Mic 56-400

THE THERMODYNAMICS OF SOME COMPLEX FLUORIDES

(Publication No. 15,662)

Leland Marshall Yates, Ph.D.
State College of Washington, 1955

Using a potentiometric method, based on the change of the electromotive force of a ferric-ferrous half cell on the addition of fluoride ion, the equilibrium constants for the reaction



in which n is 1, 2, or 3 and M^{+z} is Fe^{+3} , Be^{+2} , or Ga^{+3} have been determined at 5°, 25°, and 50° C at an ionic strength of 0.50 and an initial hydrogen ion concentration of 0.05.

Using the values determined, the molar heat of reaction, standard molar free energy change, and standard molar entropy change have been calculated. In these calculations the validity of the limiting law of Debye and Huckel in the form $-\log \gamma = A Z^2 S^{1/2}$ is assumed.

The results are listed in Table 20.

TABLE 20
RESULTS DETERMINED IN THIS WORK

| M^{+z} | n | K_5^0 | K_{25}^0 | K_{50}^0 | ΔH_{25}^0 | ΔF_{25}^0 | ΔS_{25}^0 |
|------------------|-----|--------------|--------------|----------------|-------------------|-------------------|-------------------|
| Fe^{+3} | 1 | 198 ± 10 | 183 ± 10 | 170.3 ± 10 | - 620 | -5054 | + 14.9 |
| Fe^{+3} | 2 | 13.3 | 9.7 | 8.8 | -1650 | -2332 | + 2.28 |
| Fe^{+3} | 3 | .91 | .79 | .295 | - - | - - | - - |
| Be^{+2} | 1 | 170 ± 15 | 131 ± 10 | 73 ± 7 | -3400 | -3842 | + 1.48 |
| Be^{+2} | 2 | 7.06 | 6.94 | 4.65 | -1735 | -1145 | - 1.97 |
| Be^{+2} | 3 | 0.167 | 1.08 | 0.184 | - - | - - | - - |
| Ga^{+3} | 1 | 43 ± 3 | 35 ± 3 | 31.5 ± 3 | -1300 | -4074 | + 9.31 |
| Ga^{+3} | 2 | 5.8 | 4.0 | 4.0 | -1490 | -1907 | + 1.40 |
| Ga^{+3} | 3 | 1.0 | 0.36 | 0.20 | -5500 | + 618 | - 20.5 |

ΔH and ΔF^0 are given in calories per mol, ΔS^0 is in calories per mol per degree.

72 pages. \$1.00. Mic 56-401

ECONOMICS

ECONOMICS, GENERAL

PUBLIC PURCHASE OF LAND AS A MEANS OF LAND USE ADJUSTMENT

(Publication No. 14,699)

Loyd Glover, Jr., Ph.D.
The University of Wisconsin, 1955

Supervisor: Associate Professor C. W. Loomer

From 1933 to 1941 drouth and depression in the United States revealed many areas of maladjusted agricultural land use. Primarily these were areas where too intensive agricultural use had been attempted. Symptoms of poorly adjusted land use were: extreme rural poverty, tax delinquency, mortgage foreclosures and abandonment of land.

In the worst regions of land misuse the government inaugurated a program of land purchase for the purpose of adjusting the use of land. In terms of area most of these purchases were in the Northern Great Plains, and the use-adjustment planned was from crop farming to grazing.

The projects formed from these purchases were an experiment in land use adjustment through public purchase and were called land utilization projects.

The experience gained from the program establishing these projects has never been studied except during the period of purchase and organization. Today there is need for a complete evaluation of the program for two reasons. First, the idea of public purchase of land for land use adjustment is being mentioned in connection with the drouth areas of the Southwest. Second, suggestions are being made that the present land utilization projects be sold.

This thesis attempts to provide a framework and guide for the evaluation of the land purchase program. The material presented includes a case study of the Perkins-Corson Land Utilization Project with headquarters at Lemmon, South Dakota. A study of the problems of that project suggest several issues and hypotheses for a regional study of the land utilization projects of the Northern Great Plains. Some of these issues concern charges for leasing the public land, payments in lieu of taxes, size of operating units fostered, possible subsidy to users, and future disposition of the lands.

By reference to other studies comparisons are made of land purchase with other means of accomplishing land use adjustment. The comparisons are with cooperative grazing associations, soil conservation districts' land use ordinances, rural zoning, block leasing, taxation, and county land management. The conclusion is reached that none of these means is a complete substitute for land purchase, and that most of them are complimentary and most effectively used in combination with one another.

The suggested framework for evaluation of the land use purchase program is, briefly, as follows:

1. Evaluation of the program itself.
 - a) Achievement of objectives by individual projects.

- b) Comparison with areas where other means of land use adjustment, or no means at all, were used.

2. Disposition of the project lands.

- a) If to be sold, to whom, and with what restrictions use, if any?
 - b) If to be kept, then recommendations for future management to be based on results of evaluation under "1" above.

As a social experiment the land use purchase program will not have achieved its purpose until its results are studied and the experience obtained is made available to others working on similar problems of land use adjustment.
104 pages. \$1.30. Mic 56-402

A REPRESENTATIVE COLONIAL ECONOMY IN BRITISH IMPERIAL PREFERENCE TRADE

(Publication No. 15,646)

William E. Gordon, Ph.D.
Princeton University, 1955

The economy of the British colony of Jamaica in the West Indies has had four distinguishable periods of existence. (1) from 1664 to the latter part of the eighteenth century, (2) from the early nineteenth century to 1838, (3) from the mid-nineteenth century to 1915-1932, and (4) from 1934 to the present time. From 1664 to 1865 the planters usually made their own decisions for the economy, such as it was, but from 1866 to 1952 economic policy has been formulated by British Governments, mainly by civil service officials in the Colonial Office. Both have had a single main objective: to maintain the colony as a producer of raw cane sugar and its by-products and as a market for British manufactures. Hence, the long periods of existence without development.

In the first period the sugar cane became the main crop. This was due to (1) British tariff preference, and (2) high tariffs on other Jamaican agricultural products. The large sugar-cane plantation became characteristic of the landscape. The proprietors enjoyed high prosperity, in England, but it was precarious. Many of the plantations were in debt, production was inefficient, wasteful and expensive, the cost of labour rose through increase in the import duty on Africans, the price paid for each labourer increased, and the Navigation Laws required that colonial sugar be exported exclusively to Britain, for most of this period. High preferential import duties on refined sugar left the planters no choice but to export their sugar raw. The preferential duty on this sugar too was high and all of it was not always drawn back on re-export. Jamaican raw sugar could not be sold in Europe in competition with French colonial and Cuban sugar.

In the period 1801 to 1838-1846 production of sugar in Mauritius was increased to the output in Jamaica. The specific import duty on Jamaican sugar increased continuously. Prices fluctuated widely with a downward trend, and this reduced the incomes of the planters. The planters evidently had to absorb part of the duty. Then the tariff on Mauritius sugar was reduced to the rate on Jamaican sugar, and foreign sugar was later admitted at this rate, when imported for re-export.

The period 1838-1846 to 1915-1932 was the free trade era. Forced labour was discontinued in 1838. Many African workers acquired and cultivated land for themselves, wages rose and consequently the cost of production of sugar. British tariff preference was withdrawn for the period 1874-1901 and Britain imported subsidized beet sugar from Europe. The British price fell very low. These events caused economic distress in Jamaica. Trade with Canada and the United States increased but the Canadian tariff was of the British pattern. The trade with the United States declined rapidly when Philippine, Puerto Rican and Hawaiian sugar could be imported into the United States duty free and Cuba received a low-tariff quota. Britain imported larger quantities of sugar from Cuba. A preferential tariff was given colonial sugar again but the quantity was limited.

In 1934-1952 specific duties and quotas were imposed on imports of cheap footwear and cotton goods. These were intended to exclude Japanese and United States' goods. The costs to Jamaican consumers were increased, but Japanese exports of the same textiles in the world increased relative to British exports. The British market for and price of Jamaican sugar were increased. The International Bank for Reconstruction and Development submitted the first comprehensive recommendations for actual development. 450 pages. \$5.63. Mic 56-403

A STUDY OF AREA WAGE STRUCTURE AND WAGE DETERMINATION IN THE BUILDING CONSTRUCTION INDUSTRY OF CENTRAL NEW YORK STATE, 1942-1951

(Publication No. 15,603)

William George Hosking, Ph.D.
Cornell University, 1955

This study deals with factors which influence wage determination and intercity wage structure in the building industry. Specifically it is a case study of the attitudes and opinions of building tradesmen and contractors which play a part in wage decisions. The study covers the period from 1942 to 1951, and includes a period of five years in which wages in the building industry were controlled and a period of five years when wages were free from controls. The period can be described as one in which the demand for building craftsmen generally exceeded the supply of them in the geographical area covered in the study. The information upon which the conclusions are based was gathered from interviews with over 200 building tradesmen and 50 contractors in six cities in central New York State. The interviews were undertaken over a period of three years, from 1951 to 1953.

The study is divided into two parts. Part I is a general

presentation of wage "points-of-view" associated with particular economic and social conditions found among building tradesmen and contractors in the various cities where interviewing took place. Analysis of the interviews indicated that wage "points-of-view", -which were ultimately reflected in wage rates- varied, depending on such factors as:

1. Age, skill, and work experience of the tradesman.
2. Type of building work most important to tradesmen and contractors.
3. Size of cities in which tradesmen and contractors bargained.
4. General bargaining climate in cities, i.e., whether or not licensing laws existed, whether or not the building trade council was strong, whether or not business agents were strong.

Part II deals with the relative importance of particular wage determining factors in specific cities and for specific trades. It is essentially an analysis of the intercity wage structure and attempts to account for the stability observed in the intercity wage structure. An attempt is made in Part II to explain the persistent difference in wages paid between the larger cities and the smaller cities, the persistent difference in wages paid among the smaller cities, and finally the persistent difference in wage variation among the crafts, when each craft is looked at separately and compared with each of the other crafts. A chapter in Part II is devoted to analyzing the effects of World War II wage control on the intercity wage structure.

The value of a case study such as this one lies not so much in what is found in the case *per se* as in the suggestions that can be made on the basis of the study for further research in the field. Therefore, an attempt was made in the final chapter of the thesis to point out where the findings of this study might be useful with broader application. Suggestions made were as follows:

1. It is highly important in any study of the building industry to recognize at the outset that there are different types of building demand each of which has its own peculiar economic characteristics and each of which presents different problems to the people in the building industry.
2. The findings of this study suggest that economists may have over-estimated the relative importance of the short-run view as a factor in wage determination. Building tradesmen, at least, frequently allow their estimates of possible future conditions to influence current wage negotiations.
3. The findings of this study also suggest that the institutional factors which have been afforded a great deal of attention in recent years as primary wage determining factors, are only significant where the economic situation allows them to be. They are not factors which operate independently of other market factors.
4. This study also suggests that workers (contrary to the popular notion) can and do make estimates of market situations which show a great deal of insight based on long experience in the labor market. This study indicates that the union estimate of the

relationship between the demand for building workers and the supply for which they felt responsible, was a first and independent influence on the size of the union demands and on the ultimate rate settlement. 225 pages. \$2.81. Mic 56-404

AN EMPIRICAL COMPARISON OF LEAST SQUARES AND LIMITED INFORMATION ESTIMATES IN THE PRESENCE OF SHOCKS AND ERRORS

(Publication No. 15,234)

George Wells Ladd, Ph.D.
University of Illinois, 1955

This thesis uses sampling methods to study the behavior of least squares and limited information single equation estimates when all variables contain observational errors and each equation contains a random shock. The model and data were constructed to meet all conditions required for limited information estimates to be maximum likelihood estimates, except one--the absence of errors of observation.

The procedure followed was to choose a two equation over-identified model; specify the values of the coefficients and the constant term in each structural equation; and select the population values of the means, variances, and covariances of the normally distributed shocks and exogenous variables measured without error. A sample of thirty observations from the specified multi-variate normal population was constructed using a table of random normal deviates. Then the sample values of the endogenous variables measured without error were computed from the reduced form equations.

The errors of observation have means zero; are normally and serially independently distributed; are independent of each other, of the shocks, and of the true values of the variables. The variances of the measurement errors were selected, and thirty independent random samples consisting of thirty observations on the measurement error in each variable were constructed from the specified population, again using the table of random normal deviates. The values of the errors of observation were added to the values in the sample containing no observational errors as in $x_i^j(t) = X_i(t) + e_i^j(t)$, where $X_i(t)$ is the value of the i -th variable at time t in the sample containing no measurement errors, $e_i^j(t)$ is the error of measurement in the observed value of the i -th variable at time t in the j -th sample, and $x_i^j(t)$ is the observed value of the i -th variable at time t in the j -th sample. ($t = 1, \dots, 30$; $j = 1, \dots, 30$; $i = 1, \dots, 6$ (four exogenous and two endogenous variables)).

The least squares and limited information single equation methods were applied to each of the finite samples and to two infinite samples--one containing observational errors and the other not containing them. The tentative conclusions can be summarized as follows:

- (1) The presence of errors of observation imparts little bias to least squares or limited information estimates, on the average, but does increase their standard errors.
- (2) The distribution of limited information estimates approaches the normal distribution quite rapidly with increasing size of sample.
- (3) The t test, applied to the

differences between least squares and limited information coefficients, rejects the null hypothesis on five of the six coefficients; on two because of the sizeable bias in the least squares estimates due to correlation between the disturbance and an endogenous variable on the right side of the structural equation, on two because of the differential effect of errors of observation on the two methods, and on one because of the different impact of the random errors of sampling in the sample containing no observational errors. (4) The least squares method can be applied directly to a structural equation having endogenous variables on the right hand side if the covariance between each endogenous explanatory variable and the shock is small. Even in some cases in which this covariance is quite high there may be a coefficient whose least squares bias is negligible. However, in a typical situation we do not know when either of these situations exists, and it would be the safer, more conservative approach to use the limited information single equation method. (5) The estimated limited information standard errors and variances understate the reliability of the corresponding coefficients because of something inherent in the method, because of the presence of errors of measurement, or because of a combination of the two. In an equation with moderate or high covariance between an explanatory endogenous variable and the shock term, the least squares standard errors consistently over estimate the "true" standard errors.

109 pages. \$1.36. Mic 56-405

CONTROL OF INVESTMENT IN BUILDING IN GREAT BRITAIN 1945-1949

(Publication No. 14,731)

Nathan Rosenberg, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor James S. Earley

This thesis is an examination and appraisal of the methods of economic control employed by the Labor Government in the years 1945-1949 in attempting to determine the nature of the output and to regulate the allocation of resources in the most important of the investment industries. Attention is centered on the techniques available to the Government for translating specific building plans into actuality. The Government's building program in the post-war years is examined with reference to (1) the peculiar structure and organization of the building industry; (2) the availability of building workers and materials; (3) the Government's machinery for regulating building demand and determining the uses to which building resources are put; and (4) the consequences of Government policy decisions relating to the building industry.

At the end of World War II the British Labor Government undertook to regulate the output of the building and civil engineering industries. As a result both of the damage suffered during the war and the deliberate policy of deferring virtually all building for civil purposes which made no direct contribution to the war effort, the demand for building work in the post-war period was immense. Furthermore, both the building and building materials industries had been reduced during the war to fractions of

their pre-war sizes. The enforcement of the Government's building priorities required a swift and coordinated expansion of these industries and a strict regulation of building demand. Not only was it essential to prohibit outright many types of unessential building work; of equal importance for the orderly progression of the Government's building program was the requirement that the total amount of essential building work undertaken be limited to the availability of building resources.

Although the Labor Government's general approach to the regulation of building demand was a reasonable one, the Governmental apparatus for the planning and programming of building output possessed serious deficiencies in the years 1945-1947, but was improved considerably in 1948 and 1949. The controls were largely successful in preventing the use of building resources for non-essential purposes, and in providing a degree of stability which enabled the industry to carry out a large program of new building while undertaking at the same time an enormous volume of repair and maintenance work which was an inevitable aftermath of the War.

However, the Government's building program was seriously hampered by policy decisions which failed to recognize the limited effectiveness of the building controls. The Government consistently pursued policies which could be successful only if it possessed a detailed, comprehensive control over all building resources. Since the controls were in fact much more limited in their scope, the Government's program was continuously frustrated by its inability to direct building resources to specific uses and by the movement of building resources into the uncontrolled sector of minor repair and maintenance work. In particular, policy decisions which required the transfer or redistribution of building resources, even within the building industry, were almost impossible to translate into practice.

251 pages. \$3.14. Mic 56-406

HIGH QUALITY ROUGHAGE: PROFITABLE USE ON A WISCONSIN DAIRY FARM

(Publication No. 14,741)

Edward Joseph Smith, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor P. E. McNall

The study reported in this thesis builds upon an earlier one, published under the title, "Grass Silage: Wisconsin Farmers' Methods, Costs and Results" (Ag. Econ. 10, University of Wisconsin, March 1954). In that publication, the present writer examined the experience of a number of Wisconsin farmers in the production and use of grass silage. The main purpose was to determine the most important obstacles preventing the more general use of grass silage, and how those obstacles might be overcome. Prevailing methods were analyzed to find out how they could be changed to improve results and lower costs. That study implicitly assumed that, if properly done, the ensiling of hay crops would prove profitable on the typical Wisconsin dairy farm.

It was that assumption which this thesis examined. The writer applied budgetary analysis to a synthesized farm

organization to estimate the probable changes in income and expenses that would result from growing more hay crops, together with a shift from field-cured hay to grass silage or barn cured hay.

This study was concerned only with the economic effects of increased production of high-quality, palatable roughages. It was not intended to apply where roughages are of only average (i.e., fair) quality. It was assumed that the farm operator was a reasonably capable manager, and made effective use of each alternative method considered.

The dairy cows on this "synthetic farm" were assumed to be of about the level of inherent productivity of the "low stations-poor cows" of the Jensen-Woodward study (U.S.D.A. Tech. Bul. 815). Grain was fed in optimum amounts in every case except the first one. The analysis was made within the framework of a given livestock organization, and on the basis of prices and costs prevailing in the period 1946-53.

Plan 1 represented the typical or prevailing system followed in the area. A combination of a three and a four year rotation was used. Winter roughages were corn silage and field-cured hay.

Analysis revealed that purchased high protein feeds used in Plan 1 were not needed. A modified system was therefore set up, under which a simple grain ration of corn and oats was fed with corn silage and field-cured hay. This change increased net income more than \$350.

Under each of the other four alternatives a five year rotation (corn, oats and three years of hay) was used. Under Plan 2, all first-cutting hay was ensiled, and fed with corn silage and a little hay in an all-roughage ration. Plan 3 eliminated corn silage, but moderate amounts of grain were fed to the dairy herd. Under Plan 4, both hay cuttings were barn-dried and fed with corn silage in an all-roughage ration. Plan 5 represented a combination of grass silage and barn-dried hay, fed with corn silage in an all-roughage ration.

The writer concluded that dairy farmers in the area would find it profitable to produce and feed considerably larger amounts of high-quality forage than is commonly done. Grass silage appeared to be the most economical way of doing this, followed closely by a combination of grass silage and barn-dried hay.

It did not appear advisable to replace corn silage entirely with grass silage. Rather, it would seem well worth while to construct additional silo space so that both corn and hay crops can be ensiled.

103 pages. \$1.29. Mic 56-407

THE POLITICAL ECONOMY OF PETROLEUM CONSERVATION—A CASE STUDY OF OKLAHOMA

(Publication No. 15,387)

Eugene Laurrel Swearingen, Ph.D.
Stanford University, 1955

The economic effect of state regulation of the petroleum in Oklahoma is the primary concern of this dissertation. The problems of oil and gas conservation, particularly as these problems have developed in Oklahoma, are discussed. However, the market for petroleum produced in the Southwest is for all practical purposes a single market, and the

regulation of one state has direct bearing upon production and marketing practices of nearby states. Hence, the principles derived from this study are thought to have almost direct application to all Midwestern oil- and gas-producing states.

Nontechnical language is used as much as possible throughout the dissertation, and both engineering and economic terminology are explained when it seems necessary to use more technical language.

The Oklahoma Corporation Commission enforces all conservation statutes in Oklahoma. The Commission is subject to many political pressures in attempting to reconcile the conflicting interests of royalty owners, major oil companies, and nonintegrated firms. Moreover, the Commission must be concerned with the effect of its decisions upon the tax revenue of the state, because (as the study shows) approximately fifty per cent of the total tax revenue accruing to the State of Oklahoma is ultimately traceable to the petroleum industry.

The importance of petroleum to the economy of Oklahoma and the important part which Oklahoma plays in the production of petroleum are explained. Drilling activity and the location of proved reserves are discussed to establish the point that future production of petroleum is likely to be concentrated in essentially the same few states which now predominate in petroleum production.

The theory of petroleum conservation is developed, and this is followed by three chapters which deal with the determinants of demand, supply, and price in the production stage of the industry.

A historical analysis of the early development of Oklahoma's conservation program is followed by a detailed discussion of the three major problems of petroleum conservation: prorationing, well spacing, and unit operation. Prorationing involves limiting production in a state and "prorating" the state allowable among the wells of the state. The arguments for and against prorationing are developed, and the conclusion is reached that prorationing has stabilized the price of crude petroleum. Prorationing is not a perfect conservation device, but it is more socially desirable than the former policy of unrestrained competition. Well-spacing statutes, which affect both the density and location of wells, have reduced the investment required to recover a given quantity of petroleum.

For maximum efficiency, the entire reservoir should be treated as a production unit. However, property lines on the surface have caused the wells penetrating a reservoir to be operated as if they were independent. The result of this practice has been wasted reservoir energy and unnecessary drilling of wells. In addition, repressuring, cycling, and water-flood operations are economically feasible only when applied to the entire reservoir. Unit operation is a legal device which pools the interests of all property owners in the reservoir. The optimum size production unit is thus established. The economic effects of unit operation are developed in the dissertation. Several types of reservoirs are discussed in order to show that unit operation is the only method of obtaining maximum recovery of petroleum in most reservoirs and, at the same time, protecting the correlative rights of property owners.

A chapter is devoted to the interstate aspects of petroleum conservation, particularly the role of the Interstate Oil Compact. The actions of the major producing states are studied, and the conclusion is reached that these actions can be explained in terms of economic theory.

407 pages. \$5.09. Mic 56-408

PATTERN OF FOREIGN TRADE AND ECONOMIC DEVELOPMENT OF AN UNDERDEVELOPED ECONOMY: INDIA BEFORE AND SINCE INDEPENDENCE

(Publication No. 15,507)

Omprakash Talwar, Ph.D.
Cornell University, 1955

The intimate link between the character of foreign trade of a country and the level of its economic maturity is well-known. If a country is lagging behind in economic development, the volume and composition of its foreign trade usually reflect most of its internal weaknesses; contrariwise, a prosperous country generally possesses a well-developed structure of foreign trade.

On this broad premise this study explores and analyses the pattern of India's foreign trade in the context of her economic development. By and large this is a study in applied economics. While the aim throughout is to bring the general principles of economic theory to bear upon particular economic problems, statistical data are used in great detail in support of the arguments advanced. In general, attention is focussed on three five-year periods: 1924/25-1928/29, 1934/35-1938/39, and 1948/49-1952/53.

The study is divided into eight chapters. Chapter I describes the nature of the problem and its setting. Chapter II examines the place of foreign trade in a developing economy. It questions the unqualified use of indicators like the percentage share of a country in world trade, foreign trade per capita, or the average propensity to import. In a developing economy attention has to be paid to the strategic role of certain imports, whether in completing development projects or in curbing inflation. Besides, it is necessary to take into account the role of foreign capital and the contribution of customs duties to state revenues.

Chapters III and IV analyse the structure of India's import and export trade, respectively. They bring out the implications of the shifts in the character of the country's foreign trade. Evidence is presented to show that India has passed from the stage of a primary producing country to a less industrialized type of economy. It is shown that the relationship between imports and national income is rather complex. The discussion brings out that the imports of consumer goods have an important demand creating function, a point which has been neglected by the adherents of "demonstration effect" in international trade. Among other things, Chapter IV also presents a section on the three major concepts of the terms of trade.

The three chapters that follow are devoted to a study of the effects of certain important policy decisions. Chapter V traces the effects of protection on industrialization. Besides reviewing the conceptual aspects of the problem, wherein it is shown that developmental protection is fully compatible with the dynamic aspects of the theory of comparative advantage, it presents a critical appraisal of the tariff policy of the State before and since independence. Chapter VI explores the impact of exchange rate policy on economic development. The variations in the exchange rate have had far-reaching effects on the economy of the country; in fact, India's industrial growth was hampered during the inter-war period as a result of an unsound exchange rate policy. The discussion also indicates the complexity of conditions that are necessary for devaluation to be successful. The penultimate chapter discusses the role of foreign capital in India's economic development.

From the vast canvas of history it draws conclusions which are pertinent to the contemporary situation.

The final chapter is in the nature of an essay on economic policy; it examines both the desirability and the possibility of planning foreign trade to suit the general development programmes of the country. It is argued that there need not be any dichotomy between planning of foreign trade and international economic cooperation. Economic planning is fully compatible with the price mechanism, an expanding volume of world trade and the restoration of multilateral trading pattern. The chapter also explores suitable techniques for the planning of foreign trade of the country, and in the process gives practical shape to the conclusions suggested in the earlier chapters.

472 pages. \$5.90. Mic 56-409

ECONOMICS, COMMERCE — BUSINESS

MARKETING AN INNOVATION

(Publication No. 15,625)

George Arthur Edwards, Ph.D.
Columbia University, 1955

The objective of this study is to examine two basic marketing questions concerning the introduction of an innovation (a new product) to the consumer market. First, what is the nature of the managerial decisions involved in planning the innovator's marketing campaign? Second, what economic and social costs are attributable to translating such marketing plans into action through the mechanism of a channel of distribution?

This study is divided into two parts. Part I develops a conceptual scheme—a framework of analysis—to be used in examining the innovator's planning and activity in the market place. Part II supplies illustrative material in order to relate the abstract analysis of Part I to a specific marketing situation.

Three chapters of Part I present an analytical description of the way in which the consumer buys. The theme of these chapters is that in buying a product the consumer moves through six steps, defined as the "buying process." These steps include (1) the recognition of a need (motivation), (2) the awareness of merchandise information, (3) possible deliberation in evaluating alternative products, (4) product selection (decision making), (5) contract negotiation, and (6) termination procedures (delivery, payment and warranty). The fourth chapter defines a channel of distribution as consisting of the innovator, the consumer and, where necessary, separate marketing firms—all functioning as a group to the end that the buying process may be initiated and terminated.

The fifth chapter of Part I offers a number of generalizations. It may be expected that the innovator will take the initiative in planning a marketing campaign so as to energize and facilitate consumer buying at each step of the process. The effectiveness of the innovator's marketing

strategy depends as much on his recognition of the limits of consumer flexibility within prevailing economic conditions as on the brute strength of his promotional aggressiveness. It may be expected that the innovator's marketing planning will be characterized by critical uncertainty as to consumer response to his offerings. As a result, the early stages of his program will be marked by a series of adjustments as he attunes to consumer behavior. These give rise to "adjustment costs" consisting either of an experimental marketing program or of almost inevitable waste effort due to misdirected marketing effort. The necessity of creating a marketing channel requires non-recurrent marketing costs that are quite distinct from the costs of performing the marketing functions. These "costs of channel creation" differ from "adjustment costs" in that they are incurred irrespective of uncertainty. It may be expected that the marketing channel established for the introduction of an innovation will undergo significant change in the nature of the tasks performed, if not in composition and structure, as the consumer becomes familiar with the product and buys it habitually. The necessity of maintaining a working relationship among channel members leads to marketing costs that are quite distinct from the costs incurred by each member in performing his share of the marketing burden. These "channel maintenance costs" may be defined either as the actual effort required to keep a channel in line with changing consumer behavior or as the inefficiencies and lost opportunities resulting when a channel is not so aligned.

Part II outlines a marketing history of the frozen food industry between 1930 and 1952. It focuses principally on certain introductory marketing experiments in the early 1930's, on the creation and maintenance of marketing channels, on the nature of (and limits to) innovator initiative in introducing frozen products (especially frozen packaged meats and frozen citrus concentrates), and on the impact on existing marketing channels of the delayed entrance of national chain stores into the distribution of frozen products.

413 pages. \$5.16. Mic 56-410

DEVELOPMENT OF A COURSE OF STUDY IN INCOME TAX ACCOUNTING FOR BUSINESS EDUCATION TEACHERS

(Publication No. 15,545)

Jay Morrison Greene, Ed.D.
New York University, 1955

Statement of the Problem

The purpose of this study has been to (1) determine subject matter that might be included in an income tax accounting course and noted to be beneficial to business education teachers, (2) determine the topics to be included in the course offered at Whitewater State College (Wisconsin) in terms of the need of business education graduates, and (3) develop a course of study, based on the findings: this course of study to be in the form of an outline of topics. The content, organization, sequence and time allotment of the content were the characteristics evaluated for the course.

Method of Procedure

A search of business education literature, income tax regulations, federal tax service textbooks, and income tax forms produced 277 tax topics that were available for study in the course. Checklists were sent to two groups of graduates. One group studied income tax accounting in college. The second group, selected by random sampling, did not have the course in college. Eighty-eight business education graduates gave opinions of need for the topics (1) to solve personal tax problems, (2) to solve the problems of other taxpayers, (3) to understand the general information value or the impact of income taxation on self, friends, community and nation, or (4) to indicate if the topics were never needed in any of the three ways above. Furthermore, the graduates indicated whether each topic should be learned in college or on the job. Responses were tabulated and arranged by percentiles. When a majority of the graduates indicated the topic was needed and ought to be learned in college, the provisions were satisfied to apply evaluative criteria. Topics measuring up to evaluative criteria were arranged into 16 units and handed to a jury of competent accounting instructors to secure a consensus as to the sequence of units and the time to be allotted each unit. A two-credit course was developed which allowed time for testing and special laboratory problems and was appropriate for business education students at Whitewater State College.

Summary

1. A total of 171 of 277 topics met the criteria for inclusion in the course of study.
2. Ninety-five per cent of the graduates prepared their own tax returns, and 70 per cent aided others to prepare returns.
3. Tax forms filed according to frequency were: 1040, 941, Schedule C of 1040, and 1040F.
4. Corporation, fiduciary, and estimated tax returns were rarely filed by the respondents.
5. The percentage of graduates in favor of studying the topics in college was larger than the percentage of graduates who needed the topics.
6. The graduates needed the topics more for the technical information than the general information value.
7. Graduates who studied income tax accounting in comparison with graduates who had not studied income tax accounting in college showed: (1) nearly the same need for personal understanding of the topics, (2) slightly greater need for the topics to help other taxpayers, (3) less need for the general information value of the topics, (4) more need for the general introductory, withholding, gross income inclusions and exclusions, capital gains, and fiduciary groups of topics, (5) less need for the assessment-collection-refund, accounting, inventory, dividend, deductions, partnership, and corporation groups of topics.
8. The deductions topics were the most frequently needed by both groups of students.

Recommendation

A reconstructed income tax accounting course should be offered at Whitewater State College.

The technique employed in this study is recommended to the instructor with the practical problem of not wanting the sole responsibility for selecting content, sequence, and time allotment.

284 pages. \$3.55. Mic 56-411

DEVELOPMENTS IN FURNITURE RETAILING

(Publication No. 15,226)

Melvin Humphrey, Ph.D.
University of Illinois, 1955

Purpose of the Study and Methodology

This is a study of the transition in furniture retailing as exemplified by the history of two retail furniture stores. The object was to determine to what extent the two firms were able to modify their business policies and practices and thereby survive in new environments.

The approach to this task begins with a general survey of the retail furniture store business and then proceeds to a more specific study of two retail furniture stores. The Kiler House Furnishings Store in Champaign, Illinois, and the Kirkpatrick House Furnishings Store in Bloomington, Illinois are the two firms used in the study.

Conclusions

1. The retail furniture store is a product of the economic and social forces in the economy. As the economy undergoes changes, the retail furniture institutions pass through periods of transitions. Each transition in furniture retailing has resulted in a higher degree of specialization. The higher the degree of specialization, the more complex the problems of furniture distribution.

2. Specialization in the retail furniture trade is determined by the extent of the market and by the degree of competition within the market. As the market and the competition for home furnishings increase, the retail furniture store tends to discontinue other business activities and to specialize in the retailing of home furnishings. The specialization in home furnishings is accompanied by additional methods of sales promotion. These lead to further competition, and hence price-competition.

3. The history of the two firms provides a more detailed account of the general development of furniture store retailing and the manner in which it has responded to the economic and social forces in the economy. The development of furniture retailing in both cities appears to have had the same general characteristics as that found in other mid-western cities. The furniture retailers in the two cities modified their business practices to fit the local market conditions. As the market widened, both stores tended to specialize more in the area of furniture and home furnishings distribution. Both firms adopted business policies best suited to their particular type of operation. One engaged in extensive advertising; the other in intensive advertising. One stressed quality products more vigorously than the other. One used the price appeal more strenuously than the other.

4. The business experiences of the two firms indicate that it was possible for two firms engaged in the same kind of business and competing in the same type of market to vary business policies and practices, and yet be successful institutions in the trade group.

5. The development of the retail furniture store and the history of the two firms reveals that furniture retailing has not differed materially from the development in other kinds of retail trading. The furniture store has gone through stages of development similar to those of other trade institutions.

It, too, has been affected by the changes in the economy. It, too, has responded by adopting newer methods of operations. As the economy changes, the retailing system and the method of retail operations will change. Furniture retailing will do likewise. It is not immune to the environment. It is not static. 203 pages. \$2.54. Mic 56-412

A STUDY OF FLOWER MERCHANDISING IN SELF-SERVICE OUTLETS

(Publication No. 15,678)

John Ludwig Kupka, Ph.D.
Cornell University, 1956

This study was conducted in order to test the effect of various methods of display, packaging, and pricing on sales of packaged cut flowers in self-service grocery, variety, and drug stores. Seasonal changes in sales were measured, and estimates of costs of marketing packaged flowers commercially were made. Sales data were obtained from experimental tests conducted in a total of thirty-two stores in Nassau County, Long Island, and in Rochester, New York.

Comparisons were made of sales of roses, carnations, and pompons from displays in produce racks, on table tops, and in special upright racks. Sales data from six supermarkets where the displays were tested showed that slightly more flowers were sold from table top displays, though the selling advantage of this display over the other two was not significant.

Sales of flowers in simple cello-wrap packages and in sealed tray-type box packages were compared. More roses were sold in boxes, while more carnations were sold in cello-wrap packages. Pompons sold equally well in either type of package. Though these data indicated that carnations and pompons should be merchandised in the less expensive cello-wrap, it was not possible to measure in dollars and cents the importance of the protection from handling damage afforded by the sturdy paperboard box.

Tests of effects on sales of rising and declining price sequences were carried out to determine the nature of the demand for packaged flowers, and to find out whether consumers would accept retail prices which varied in a manner similar to fluctuations of wholesale prices of flowers. The packages were priced within a range of 99¢ to \$1.79 for roses and carnations, and 39¢ to 79¢ for pompons. Sales data were adjusted for variations in volumes of store traffic, income levels of the various communities where stores were located, and for the net effect of other variations not due to price changes.

Elasticities of demand for flowers were found to be about the same during either rising- or declining-price sequences. When prices were lowered dollar volume of sales of flowers increased by about the same amount that they decreased when prices were raised. The similar demand elasticities when prices were declining and rising suggests that flowers can be retailed at prices which are based on the "wholesale price plus a percentage markup" formula, since no permanent buying prejudices were caused by wide changes in price.

Although the overall average pattern of demand elasticity was somewhat below unity, in the higher pricing units an elasticity greater than unity was often found. For

pricing units of less than about one dollar it may be that lowering of retail price would thus result in a decreased dollar volume of sales; while for selling units priced above \$1.50 the lowering of retail price would result in an increased dollar volume of sales.

At commercially profitable retail prices, it appears that flower sales volumes in heavy traffic outlets will be too low to justify any rapid development of such markets. However, as sales volumes per outlet can be increased through greater flower consciousness on the part of shoppers, unit costs of distribution will be lowered and retail prices can then be reduced. As the market broadens, it may also be that more efficient buying can be done and producers will be able to supply less expensive grades of flowers designed especially for this casual occasion, home-use market.

This broadening of the market will be possible only as consumers become accustomed to wanting flowers for frequent home use instead of just for those special occasions when the use of flowers has been dictated by custom. The efforts of flower producers, wholesalers and retailers alike will be required to bring about such a broad expansion of flower consciousness on the part of the buying public. 199 pages. \$2.49. Mic 56-413

MINIMUM WAGES IN THE PUERTO RICAN ECONOMY

(Publication No. 15,499)

Karl Otto Mann, Ph.D.
Cornell University, 1955

During the first twenty months subsequent to the enactment of the Fair Labor Standards Act in October 1938, industries on the island of Puerto Rico, a territory of the United States, were subject to the same minimum wage provisions of the Act that were applicable in all other parts of the United States. However, inasmuch as the minimum rates of pay established by these provisions of the Act increased considerably the already substantial unemployment in Puerto Rico and, thus, seriously endangered the welfare of the economy of the Island, Congress amended the Act in June 1940 and created a separate and distinct minimum wage program for Puerto Rico.

This program - now in operation for more than fifteen years - permits the establishment of minimum rates of pay on the Island that are lower than those in effect on the mainland. Such minimum rates are determined, on an industry-by-industry basis, by tri-partite industry committees that are appointed and convened by the Administrator of the Wage and Hour Division of the U. S. Department of Labor.

Public hearings held by these committees provide all interested persons an opportunity to testify and to present evidence relating to minimum wages in Puerto Rico. On the basis of the testimony and evidence obtained at these hearings, the industry committees are required to determine and recommend to the Administrator minimum rates of pay that are neither so high as to create substantial curtailment of employment on the Island nor so low as to provide any Puerto Rican industry with a competitive advantage over any industry in the United States outside of Puerto Rico. The recommendations submitted by the

committees are made effective by minimum wage orders issued by the Administrator.

The procedure employed to determine and establish minimum rates of pay for Puerto Rican industries under the provisions of the Act is quite fair to all persons on the Island and in the States who may be affected by the rates. However, in a few respects, this procedure can be improved.

The objectives of this minimum wage program for Puerto Rico are set forth in the Fair Labor Standards Act. On the basis of the very limited data that are available, it is apparent that, in all probability, at least some progress has been achieved toward the secondary objectives of this program. However, the program appears to have failed to achieve progress toward the fundamental objective of the Act with respect to minimum rates of pay on the Island: the extension to Puerto Rico of the minimum wage applicable in the States without creating substantial curtailment of employment on the Island.

Inasmuch as this fundamental objective of the Act is not reflected by the two criteria that are employed to determine minimum rates of pay for Puerto Rican industries, it is apparent that the mainland minimum wage can be extended to the Island only by an amendment to the Act or by developing the industrial sector of the Puerto Rican economy. However, any amendment to the Act that would raise the minimum rates of pay applicable to Puerto Rican industries much more rapidly than under this program would create substantial unemployment on the Island. Thus, it is evident that the industrial development of the Puerto Rican economy constitutes the best hope for achieving the extension of the mainland minimum to the Island without endangering the welfare of the Puerto Rican economy.

289 pages. \$3.61. Mic 56-414

AN ECONOMIC ANALYSIS OF THE FREIGHT FORWARDING INDUSTRY

(Publication No. 15,252)

Robert Donald Pashek, Ph.D.
University of Illinois, 1955

"Forwarding activity" involves the consolidation of small shipments into volume lots for transportation purposes by concerns who neither own nor operate the basic modes of transportation. In the modern use of the term, "freight forwarders" engage in forwarding activity, hold themselves out to the general public as common carriers for a compensation, assume responsibility for the entire transportation service, and utilize the services of underlying common carriers.

Freight forwarders were placed under government regulation in 1942 as a result of the abuses found in rail carrier and forwarder relations, the disruption of relations between motor carriers and forwarders engendered by the regulation of the motor carrier industry, and the desire of the forwarders to secure protection and economic stability under the mantle of regulation.

The development of forwarding activity is dependent upon (1) the spread in rates between small individual shipments and large consolidated shipments and (2) a sufficient volume of small individual shipments sufficient to meet the

minimum weight requirements for volume rates. The "critical spread" in forwarding activity is between the volume rate for the consolidated movement and the rate at which the goods would have moved as an individual shipment. It is out of this spread that the forwarder expects to cover his expenses and make a profit. The volume rate and the individual rate in the "critical spread" need not be for the same mode of transport. Since the "critical spread" tends to be greatest for long distance movements and for high rated commodities forwarders have primarily developed in these areas.

Although there is considerable concentration of business in a few firms in the freight forwarder industry, its importance as an indication of the degree of monopoly is debatable. If the substitutability of service is the criterion for the delineation of the classification of an industry, the carriage of less-than-volume shipments by all agencies and direct carriers of the modes of transportation would be the more appropriate for viewing the degree of monopoly. This would indicate a greater degree of competition than the concentration in the industry would indicate. On the other hand, a lesser degree of competition than is indicated by the amount of concentration is found when viewing the economic concept of the market. The freight forwarding industry concept involves the use of the entire country as the "market." Since the demand for and the supply of transport service is for the movement of a specific commodity from one specific point to another specific point, there are a large number of small local markets instead of one large nation-wide market. To the extent that the local markets are not served by all forwarders and to the extent that individual freight forwarders do not hold themselves out to carry all commodities there would be a tendency for competition to be less than the concentration in the industry would suggest.

Freight forwarders find economic justification in the existing national transportation system on three counts. They provide improved transportation either through a reduction in costs or improved service, or both. They promote rather than lessen desirable competition. They effect a greater degree of coordination within and between the different modes of transport than would otherwise be available within the existing legal and technical limitations.

The continued existence of forwarding activity depends upon future changes in the structure of other segments of the national transportation system. Cooperative effort by rail carriers or cooperative effort between the modes of transportation would have an adverse effect upon the continued existence and development of the freight forwarding industry.

170 pages. \$2.13. Mic 56-415

ECONOMETRIC MEASUREMENT OF THE DEMAND FOR COTTON IN THE UNITED STATES

(Publication No. 15,278)

Hassan Ahmed Tewfik, Ph.D.
University of Illinois, 1955

The demand for cotton has previously been studied by the single equation method but no one heretofore has used the simultaneous equations method. This thesis has the objective of exploring the possibility of studying the demand

for cotton through the use of simultaneous equations method. The demand for cotton in the United States during the periods 1921-1940 and 1921-50 is analyzed.

During the period studied per capita consumption of cotton fluctuated widely reflecting the changes which took place in factors affecting domestic consumption. Major factors responsible for variation in per capita consumption of cotton are: (1) cotton price, (2) consumer income, (3) the general conditions of business, and (4) the competition of rayon.

It is assumed that the demand function can be described satisfactorily in arithmetic linear form as well as in logarithmic linear form. Under the single equation method, the demand for cotton is treated as a function of the price of cotton, consumer income, industrial production, the price of rayon relative to the price of cotton, and time.

Under the simultaneous equations method, the demand for cotton is treated as a function of price industrial production, consumer income, ratio of rayon yarn price to cotton yarn price, and a disturbance variable. Supply of cotton is treated as a function of price, production of cotton, carry-over of cotton and a disturbance variable. Production of cotton is a function of lagged price and a disturbance variable. This model is over-identified.

In general the single equation method gave results which agree with our a priori assumptions both in signs and in relative magnitude. Even in the case where they gave a different sign (more specifically in the case of regression coefficients of income) from that assumed a priori, the result could be supported by economic logic.

On the other hand, the simultaneous equations analysis turned out many results which violated our a priori assumptions and which cannot be justified by assumptions made about the simultaneous equations models; namely the choice of the equations included in the models describing the cotton economy, the choice of the variables used in each equation, the assumption about the accuracy of the data, and the assumption about the intercorrelation between the variables. It is possible that the demand function for cotton can be better measured by measuring separately the two major elements of the demand for cotton: the demand for cotton in consumer's uses, and the demand for cotton in industrial uses.

The Results of Both the Single Equation and Simultaneous Equations Method, (Price and Income Deflated), are as follows:

| | Change in Log of Per Capita Consumption per Unit Increase of | | | | |
|------------------------|--|-----------------------------|--|--------|-------|
| | Price | Industrial Production Index | Ratio of Rayon Yarn Price to Cotton Yarn Price | Income | Time |
| 1921-40 | | | | | |
| Single Equation | -.161 | 1.485 | .221 | -.014 | -.264 |
| Simultaneous Equations | -.146 | -2.333 | -.353 | -2.954 | - |
| 1921-50 | | | | | |
| Single Equation | -.214 | .846 | -.092 | -.002 | -.562 |
| Simultaneous Equations | -.47 | -.88 | -.32 | -.057 | - |

Under the single equation method, the coefficient of determination was 0.851 for the period 1921-40 and 0.834 for the period 1921-50.

172 pages. \$2.15. Mic 56-416

INVESTMENT CRITERIA IN PLANNING FOR ECONOMIC GROWTH: AN EVALUATION AND SYNTHESIS OF THEORETICAL APPROACHES AND THEIR ADMINISTRATIVE IMPLICATIONS

(Publication No. 15,509)

A. Vaidyanathan, Ph.D.
Cornell University, 1955

The possibility of different governmental approaches to the problem of "rational" allocations of investment resources has been insufficiently explored. Accordingly, Chapter I analyses in a general manner the kinds of decisions that need to be made in any economic system and the influences that shape them. The potential range of government influence, it is shown, extends practically to all aspects of an economy. But in fact, these powers are considerably restrained: interdependencies among the various parts of the system and constraints on the full exercise of political power effectively limit freedom of choice with respect to objectives.

Discussions of investment criteria in the literature reflect different views concerning the objectives with which planners can or should be concerned. There is the "partial problem" view, where the emphasis is on particular problems of national importance; the "partial planning" view, which considers only a limited spatial segment of the economy; and the "comprehensive view", covering, ideally, all problems of all parts of the economy.

After discussing the theoretical and practical shortcomings of the "partial" approaches (Chapter II), the "comprehensive view" is elaborated in Chapter III on the basis of the "balanced growth" idea. A dynamic input-output programming model is then developed in Chapters IV and V to permit consideration of technical inter-dependencies among the sectors. Although the model disregards several crucial areas of decision, the complications involved in two of these, i.e., determination of the final bill of demand and the choice among alternative techniques of production, are discussed in Chapters VI and VII.

Estimation of the composition of a given target GNP involves assumptions as to income-distribution and employment objectives, and is thus dependent on welfare targets. Similarly, in choosing among techniques, the relative scarcity values of different factors is shown to depend on welfare priorities. The discussion on techniques also brings out certain ambiguities in the prevailing concepts of "capital intensity" and "labour intensity", and their precise significance to economic development.

This thesis places special emphasis on the interdependencies among the elements of a social welfare function, i.e., an expression of the society's welfare and welfare-determining goals arranged in some order of preference. These inter-dependencies imply that the specification of one such target restricts the freedom of choice with respect to the others.

Beyond pointing out the inter-dependencies within the welfare function, this thesis also suggests a practical method (The Reference Goal Model) by which these inter-dependencies could be considered in actual policy-making. Essentially this is a trial and error method. The economic implications of the various objectives are deduced so that the limits to the free choice of targets may be determined in successive approximations to the final result.

Finally, the practical utility of the comprehensive

planning approach and its Reference Goal version is evaluated in light of the paucity of data, the shortage of administrative personnel, and the poor quality of available administrative organization. These factors, combined with the uncertainty inherent in any attempt to look ahead, necessitate decisions based on judgement and intuition. But one value of the model is that it provides a framework for collecting and organizing relevant data, and so gives direction to these activities.

249 pages. \$3.11. Mic 56-417

ECONOMICS, FINANCE

EVALUATION OF RURAL PROPERTY ASSESSMENTS IN 15 NEW YORK TOWNS

(Publication No. 15,514)

Floyd Louis Corty, Ph.D.
Cornell University, 1955

This study examines the property assessments in rural areas of 15 New York towns with the primary objective of determining whether farm properties and rural residential properties are being equitably assessed, and also to determine the degree of inequality among individual property assessments.

Equity of assessment prevails when a reasonable degree of uniformity exists among individual levels of assessment.

$$\text{Level of Assessment} = \frac{\text{Assessed value}}{\text{Full value}} \times 100$$

Assessed values were copied from the town assessment rolls. Full values were obtained by interviewing rural property owners and asking them the question, "What do you estimate your property would sell for today?"

Sixty properties were selected in each of the 15 towns so as to include the four following elements:

1. 15 farms sold recently (1950-54)
2. 15 farms not sold during the past ten years (1944-54)
3. 15 rural residences sold recently (1950-54)
4. 15 rural residences not sold during past ten years (1944-54).

In each of the 15 towns the level of assessment for farms was found to be higher than for rural residences. For the 15 towns as a group, the average level was 40 per cent for farm properties and 25 per cent for rural residences.

Assessments on farms ranged from 8 to 133 per cent of full value; for rural residences the range was 8 to 100 per cent. Only seven properties were assessed at 100 per cent or more of full value.

Almost three-fourths of the farm assessment levels were above the 35 per cent average level computed for the 15-town area. In contrast to this, more than three-fourths of the levels for residences were below the 35 per cent average.

These data do not show that recently sold properties are assessed at higher levels than those not sold. The 15-town average indicated the level of assessment on

recently sold farms to be three per cent lower than for farms not sold, and for rural residences, the sold properties were assessed only one per cent higher than those not changing ownership.

Assessment levels were found to be generally higher for low value properties and, as a corollary to this, properties maintained in a good state of repair and appearance enjoyed relatively lower levels of assessment than those that were unattractive and permitted to deteriorate. Furthermore, there was no evidence to prove that farms in lower land classes are assessed at higher levels than those in the better land classes.

Converting tax stamps to determine the full consideration involved in the transfer of a property was found to yield values substantially different from the purchase prices reported by the buyers. The general tendency was for them to be lower than reported prices so that an average level of assessment computed from tax stamps was 4 to 5 per cent above that computed from purchase prices.

The general conclusion is that farms as a group are assessed at a higher level than rural residences, but individual inequities are prevalent for both classes of property.

There is a need for improved assessments. The assessors cannot do the job alone. Property owners should help either as individuals or as a group by calling attention to existing inequities. A property with a level of assessment which is substantially higher than the average for the district is carrying more than its share of the tax burden. The state equalization rate, as currently determined by the State Board of Equalization and Assessment, may be considered as the average level of assessment for comparison purposes.

239 pages. \$2.99. Mic 56-418

ESTIMATES OF CREDIT AND CASH SALES OF AUTOMOBILES AND AN ANALYSIS OF AUTOMOBILE INSTALMENT CREDIT EXTENDED

(Publication No. 14,751)

Philip Maxwell Webster, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor James S. Earley

Automobile credit accounts for about 50 per cent of total instalment credit, which is the most important component of consumer credit. Knowledge of why changes have occurred in automobile instalment credit is, therefore, of key importance to a complete analysis of consumer credit. Data on consumer credit currently published by the Federal Reserve Board include the total amount of automobile instalment credit outstanding, extended, and repaid, the difference between extensions and repayments measuring the net change in outstanding credit. Since repayments are determined largely by past extensions, however, an explanation of changes in automobile credit extended is particularly important to an understanding of movements in outstanding credit. The problem to which this study addressed itself was to develop additional data of use in analyzing the automobile credit extended estimates published by the Federal Reserve Board in order to provide further insight into why changes occur in this important segment of consumer credit.

This study derives monthly estimates of the number of new and used passenger automobiles sold through the use of credit and for cash for the period 1947 through 1954. Average prices were also estimated for use in analyzing changes in the average amount of credit extended on each credit sale as computed from Federal Reserve data.

The movements of cash and credit sales of automobiles and of the average amount of credit extended in relation to price shown in this study have implications with respect to the selective control of consumer credit through the regulation of credit terms. Observation of the percentage of automobiles sold through the use of credit indicated that there was little effect on the frequency of credit sales relative to cash during the 1947 and the 1948-1949 periods of credit regulation imposed by the Federal Reserve Board. There was, however, evidence of a limited effect on the percentage of credit sales during the 1950-1952 period of Federal Reserve regulation, when the use of credit was more important. The later experience suggests that the effect of selective controls on the relative frequency of credit sales will be more pronounced when, as normally, individuals rely extensively on the use of credit in making their purchases.

An analysis of the average amount of credit extended indicated that the restricting and easing of allowable credit terms under consumer credit regulation had a significant effect on the average amount of credit extended per credit sale, and that this effect continued throughout the periods during which regulation was in force. Since analysis of the percentage of cars sold on credit indicated only a limited effect on the relative frequency of credit sales, it is probable that consumer credit control during the postwar period had its greatest effect through altering the amount of credit extended in each credit transaction rather than through an influence on the number of cars sold on credit. When, however, people rely more extensively on the use of credit in making purchases, controls would probably have an important effect on the relative frequency of credit sales.

During the 1953-1954 recession, relative stability in the average credit-average price ratio indicated little tendency on the part of lenders either to restrict or liberalize their lending terms. A decrease in the relative importance of credit purchases gave evidence of more limited availability of consumer credit for the purchase of automobiles, indicating that action on the part of lenders tended to accentuate the downward movement in general business conditions. This experience suggests that credit regulation, had it been in force during this period, could have had little effect in counteracting the general business downturn. While this indicates that controls may not help to counteract a business downturn, the analysis of changes in the relative frequency of credit sales and the average credit-average price ratio during the earlier period of business expansion suggests that selective controls probably would prove useful in counteracting an inflationary upswing in business conditions.

157 pages. \$1.96. Mic 56-419

ECONOMICS, HISTORY

THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS, 1863-1955 — A STUDY OF THE ORIGIN AND EVOLUTION OF RAILWAY WORKING RULES

(Publication No. 15,526)

Reed Cott Richardson, Ph.D.
Cornell University, 1955

No other single factor has played a more important and persistent role in railway labor relations than working rules. Today, working rules constitute the chief continuing problem of labor relations in the railroad industry. This is true not only with respect to the rules alone, but also with respect to the complex administrative machinery which has been erected to deal with such rules. This dissertation describes and analyzes the origin, evolution, and current nature of working rules in an attempt to aid in a better understanding of current railway labor problems.

The evolution of working rules cannot be fully understood if studied in isolation. The historical development of working rules and their importance in contractual relations are a direct reflection of the administrative response of both the railway companies and the unions to conditions of operation and employment which are unique to the railroad industry. Consequently, to give proper perspective and to establish a framework within which the working rules and their evolution can be more fully understood, they are discussed as part of the evolution of the railroad industry and its administration and of the railway union and its administration.

The Brotherhood of Locomotive Engineers has been selected as the basis of this study for two reasons: one, the development of working rules has a longer continuous history in this union than any other railway labor union; two, a clearer picture of the evolution of working rules can be gained by restricting the study to one group of workers.

Chapters I and II are concerned with working rules in the contemporary setting of the railroad industry and its administration and of the Brotherhood of Locomotive Engineers and its administration. Chapters III through XI then consider the evolution of working rules from 1830 to the present time within the framework established in Chapters I and II.

No attempt is made to produce a definitive history of the Brotherhood of Locomotive Engineers since a study of such variety and detail would hinder rather than aid an understanding of working rules, which set the dimensions of the more limited scope of this thesis.

Two important findings can be drawn from a study of the origin and evolution of working rules in the railroad industry. First, the railway labor union has been an extremely important force in bringing about a rationalization of administrative procedures. Second, because of their deep-rooted character in the railroad industry, working rules constitute more than an economic problem. There are also important political and social implications.

627 pages. \$7.84. Mic 56-420

EDUCATION

EDUCATION, GENERAL

A STUDY OF PRACTICES AND CHARACTERISTICS IN SECONDARY SCHOOL MUSIC EDUCATION PROGRAMS RELATED TO PARTICIPATION OF STUDENTS IN MUSICAL ACTIVITIES

(Publication No. 15,195)

Angelo Michael Cucci, Ed.D.
University of Illinois, 1955

In recent years music teachers and educational leaders have been stressing the importance of musical experiences for all school children. The music programs in some secondary schools reach a majority of the students while in other schools much smaller percentages of the students enjoy the benefits of musical experiences. The problem of this study was to identify the factors, other than size of school, per capita cost and type of school organization (found in other studies to be related to music participation), which are related to the percentage of secondary school students participating in musical activities and to derive implications therefrom for school and music administrators. These factors were sought from (1) practices and characteristics of the secondary school programs of music education, (2) practices and characteristics of the elementary school programs of music education and (3) characteristics of the communities in which the schools are located.

A personal investigation was made of the music education program in each of the 24 public secondary schools chosen for the study. The schools were selected from throughout the State of Illinois on the basis of their similarity in size, per capita cost and type of school organization. Twelve of the schools had a high percentage of students in music (39% to 63%) and 12 of them had a low percentage of students in music (18% to 26%). The various practices and characteristics of the music education programs in these schools were related to the percentage of students participating in musical activities.

The following factors were found to be significantly related to the percentage of secondary students participating in musical activities:

1. The number of periods in the school day. Because of the difficulty in arranging four academic classes, physical education and a music activity in a six-period day, those schools using the six-period plan experienced more conflicts in scheduling than did the schools using seven-, eight-, or nine-period plans, resulting in greater limitations in music enrollments.

2. Coordination between the elementary and secondary school music education programs. Generally, those school districts whose music education programs in the elementary and secondary schools were coordinated, were found to have a high percentage of students in the secondary school music activities.

3. Community music groups. Positive relationships were found between the existence of community music groups

and the percentage of students participating in secondary school music activities.

The findings of the study indicate that school administrators and music teachers who desire an increase in enrollment in their music activities should strive for (a) more flexibility in scheduling, (b) more coordination between the elementary and secondary school music education programs and (c) higher status of school and civic music groups within the community. Other practices and characteristics of the music program, not found to be related to the percentage of students participating in musical activities, must be judged on the basis of their value to the students. Since relationships were found to exist between only three of the factors studied and participation in musical activities, it was concluded that other factors, such as personality and ability of the music teachers, type of music used by the groups and the quality of performances, are in part responsible for the number of secondary school students participating in musical activities.

166 pages. \$2.08. Mic 56-421

THE DEVELOPMENT OF A PROJECTIVE TECHNIQUE DESIGNED FOR ELEMENTARY SCHOOL CHILDREN, INCLUDING AN EVALUATION OF ITS IMPORTANCE FOR TEACHERS

(Publication No. 14,705)

Wilfred Charles Harris, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Kai Jensen

Although all aspects of personality should be of interest to the informed teacher, he is most likely to be concerned with school and learning adjustment behavior. This study used projective pictures especially designed to produce responses which could be studied for fantasy expressions of such adjustment. By the use of these pictures, the collection of validating data, and the employment of non-specialists, the following problems were examined:

1. Will the specialized pictures produce useable data?
2. Which method of administration is best?
3. Can scoring categories specific to school and learning be used?
4. To what degree can non-specialists agree on scoring these stories?
5. What success will non-specialists have in predicting the school and learning status of a child from his stories?

Two artists sketched 29 pictures from written descriptions. These pictures broadly suggested situations in school and learning.

Population A, consisting of 78 children from grades four, six, eight and ten, wrote stories for pictures one to five, in class-size groups. Six judges evaluated all responses as to emotional content. It was found that idea

count and degree of emotionality correlated much higher than did word count and emotionality.

Using idea count as a criterion of a good picture, the 29 pictures were reduced to ten by administration to 383 children in grades four, six, and eight, called Population B. The order of the pictures was varied and the stories were stenographically taken. For the final step it was decided to test in groups of four, since the two methods of administration used showed little difference in the number of ideas produced.

A third group of 104 fourth to eighth graders, called both Population C, and the validating group, was tested on a variety of items presumed to influence performance on the test, as well as on the pictures. The judge reliabilities ranged from .77 to .95. The scoring categories used were teacher-pupil, pupil-pupil, pupil-subject, school in general, playground, and unclassified. In addition, the stories containing only description or mention of objects used in learning were tabulated. Ratios for constructive and non-constructive themes within each of these categories were computed.

The results seem to indicate that intelligence and academic success have little influence on the test. Best reflected were the attitudes that alert teachers observe, that children see in themselves, that peers are likely to report, and the function of chronological maturity. The correlation of all the validating data for a group of 30 children and the predictions of the judges, was .45. When the most significant items, teacher-rating, peer-rating, and self-rating were correlated, the validity coefficient was .61.

The results of the study indicate that there is value in the projective approach to school and learning problems. It may be a quicker, a more objective, and a more comprehensive way of arriving at a description of the child's attitudes in an area which should concern all teachers.

157 pages. \$1.96. Mic 56-422

**THE PROGRAMMING OF CLASSICAL MUSIC
BROADCASTS OVER THE MAJOR RADIO NETWORKS:
AN ANALYSIS OF THE EXTENT OF THE SUPPLY
BY THE FOUR NATIONAL RADIO NETWORKS OVER
THE PAST SEVENTEEN YEARS OF PROGRAMS OF
STANDARD ORCHESTRAL MUSIC AS A FUNCTION OF
THE PUBLIC INTEREST IN AND DEMAND FOR
SERIOUS MUSIC**

(Publication No. 15,547)

Leon Crist Hood, Ed.D.
New York University, 1955

This study identifies the extent of the supply by selected stations of the four national radio networks of classical orchestral music scheduled for a sample of broadcast hours from 1937 through 1953, to determine how this supply compares with the public interest in and demand for classical music as discovered in sources other than radio broadcasts.

A sample consisting of broadcasts during eight weeks for each of the years 1937, 1941, 1945, 1949, and 1953, in seven cities situated in different geographical areas of the United States where broadcasts of the four national radio networks were heard over local outlets, was examined; and

those broadcasts which devoted at least fifty per cent of their time to the works of composers appearing in Barlow and Morgenstern's *A Dictionary of Musical Themes* or Ewing's *The Complete Book of 20th Century Music* were tabulated from various listings in newspapers, network publications, and other sources.

Some of the findings are the following: Broadcasts of classical orchestral music over the four national radio networks fell from an average of 12 hours, 41 minutes a week in 1937 to 7 hours, 23 minutes in 1953, or a significant drop of 42 per cent. The networks were tending to concentrate their broadcasts of good orchestral music into fewer days of the week and to schedule these broadcasts into smaller time segments.

Indexes of public interest in classical music were examined to ascertain a measure of the public interest and demand over the seventeen years covered by this study.

It appears from an examination of these various indexes that there was an increase of interest and demand that could roughly be estimated as upwards of 50 per cent over the seventeen years from 1937 to 1953. People were attending more live concerts than seventeen years before; more symphonic societies were performing an increasing number of compositions at more concerts than in 1937; school music festivals were increasing year by year; more schools and teachers of music were turning out more students than ever before; more hours of recorded classical music were being sold than in any period of time since the invention of the phonograph; more musical instruments were being sold in 1953 than ever before; lay and professional membership and participation in musical organizations had grown by an appreciable number. Only the sales of printed music and the circulation of printed music by libraries seem not to have shown a growth exceeding the increasing price index and population growth.

This was the situation over the seventeen years covered by this study: While the public was showing more interest in and demanding more serious music, the great stimulator of that interest and one of the major dispensing agencies of good music was lessening its supply. This agency, the national radio networks, whose slogan has often been, "We give the people what they want," was apparently not practicing in accord with the precepts which it preached. These networks which claim upwards of 95 per cent of the total radio audience most evenings of the week were not in respect to this one type of program fare serving "the public interest, convenience and necessity."

If an opinion of the service of network radio to the public interest were to be drawn from the results of this study alone, it might reasonably be concluded that the potential listeners to radio network programs are way ahead of the supply from that source in their demands for and interest in quality programs; and that the networks are apparently misjudging the public's interests.

151 pages. \$1.89. Mic 56-423

PREDICTION OF SCHOLASTIC SUCCESS AS ONE PHASE OF COUNSELING SERVICE FOR ENTERING FRESHMEN IN A STATE TEACHERS COLLEGE

(Publication No. 14,722)

Judson Phillips Martin, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Alanson H. Edgerton

The purpose of this study was to develop a suitable basis for predicting scholastic success, in order that each faculty adviser might use it to assist each entering freshman in understanding his own chances of academic achievement in a particular college. The main emphasis was placed on the practical application of a regression equation to the freshman advisement program at Bemidji State Teachers College.

Variables for the equation were the Ohio Psychological Test percentile rank, the high school percentile rank, and the freshman year cumulative grade point averages of 660 freshmen who entered the State Teachers College located at Bemidji, Minnesota during the fall quarters of 1949, 1950, 1951, 1952, and 1953. The following coefficients of correlation were computed: Ohio percentile rank -- high school percentile rank .55; high school percentile rank -- grade point average .59; Ohio percentile rank -- grade point average .61. The coefficient of multiple correlation was .68. The results of the arithmetical computations produced the formula $X_1 = .0091X_2 + .0077X_3 + .4880$. X_1 = cumulative freshman grade point average. X_2 = Ohio percentile rank. X_3 = high school percentile rank.

By substituting all possible combinations in the formula, an expectancy table of "most probable grade point averages" was developed for the use of the faculty advisers. Also expectancy tables showing the percentage of students in each Ohio percentile rank or high school percentile rank whose scores fell in specific grade point average ranges were made for the use of these advisers. Directions for faculty use of these tables were written to minimize the opportunities of faulty interpretations.

A check was made to determine the accuracy of the original prediction formula when used with new data. The subjects for this check were 156 freshmen who entered Bemidji State Teachers College in the fall of 1954 and finished the winter quarter 1954-55. A correlation coefficient of .61 was computed between the actual and the predicted grade point averages of these 156 freshmen.

It was concluded that the various coefficients of correlation are significant enough to warrant the use of the prediction equation as one item when advising students on their chances of scholastic success at Bemidji State Teachers College. It was also concluded that a prediction based on both a measure of the academic aptitude and a measure of the high school record is slightly more significant than a prediction based on either of the variables alone. It is recommended that each faculty adviser concerned receive a copy of the expectancy tables together with the directions and cautions for their use so that the freshmen who attend may receive better counsel on their possibilities of attaining satisfactory academic achievement at Bemidji State Teachers College.

99 pages. \$1.24. Mic 56-424

SELECTED FACTORS ASSOCIATED WITH HIGH SCHOOL STUDENTS' ORIGINAL INTEREST AND SUBSEQUENT DEVELOPMENT OF INTEREST IN A FAVORITE LEISURE-TIME ACTIVITY

(Publication No. 15,250)

Lloyd Palm Nelson, Ed.D.
University of Illinois, 1955

I. PROBLEM

This study attempts to determine the extent to which selected factors are operative in a youth's original choice of a hobby, and his subsequent development in that hobby.

The major purposes of the study are as follows:

1. To develop an instrument which may be used to identify factors and circumstances associated with the leisure-time activities of high school students
2. To test selected hypotheses associated with circumstances which influence a youth to get interested in his present hobby
3. To test selected hypotheses relative to factors involved in a youth's development of interest in his hobby subsequent to his initial interest

II. PROCEDURE

Data used in this study were obtained from students in the larger of two high schools in a city of approximately 70,000 population. Students having a favorite leisure-time pursuit were identified by using a short questionnaire. An interview, having fifty-four questions, was used to obtain information necessary to test thirteen hypotheses relative to initial hobby interest and subsequent development of hobby interest. The responses of forty-nine students were used.

The interview schedule was administered a second time to a group of ten students after at least six weeks had elapsed, in an effort to determine the reliability of the instrument.

III. FINDINGS

Four measures employed to test the instrument's reliability yielded the following results:

1. A comparison of each student's professed hobby as stated both on the questionnaire and in the interview indicated only one unlike response out of forty-nine cases.
2. The first and second responses of ten students to nine quantitative questions in the interview yielded reliability coefficients of: .99, .98, .97, .95, .95, .93, .86, .82, and .60.
3. Of the first and second responses to forty-two qualitative items, 80.5% were found to be identical; 3.7% were similar but with different emphasis; 5.5% were identical except for a little added detail; and 10.3% were unlike.
4. The responses of all participants to seventeen pairs of questions designed to test internal consistency revealed 75% consistency.

The effect upon hobby choice and development of curricular and extracurricular school activity, parents' vocations and hobbies, friends, and out-of-school clubs was investigated.

There is insufficient evidence to single out any one factor as a strong influence. However, friends and school course work stand out somewhat among the others.

Neither the age of first interest in the hobby nor the range of participation in other activities had significant effect upon hobby "strength" at high school age.

243 pages. \$3.04. Mic 56-425

AN EXPLORATORY STUDY OF TEACHER CONCERN AND ITS MEASUREMENT

(Publication No. 15,524)

Lydia Gertrude Nygren, Ph.D.
Cornell University, 1955

The author perceives "teacher concern for individual students" as a condition in which a teacher has communicated to a student regard for his well-being. Teacher concern contributes to the quality of the student-teacher interaction and, to that extent, to teacher effectiveness. Concern is composed of three dimensions: (1) recognition, the identification of a person, (2) understanding, the knowledge of the causal factors related to a person's behavior, and (3) help, a desire and/or attempt to benefit a person. Evidences of concern, from a student's viewpoint, are the feelings he has of the teacher's recognition, understanding and desire to help him.

The exploratory study of concern proposed to learn: (1) how teacher concern is perceived and (2) if teacher concern is measurable.

A questionnaire was developed to secure a Student Estimate of Teacher Concern (SETC) yielding a total score and subscores for recognition, understanding and help. The questionnaire was administered to 53 junior high school girls in homemaking classes of four schools. The four teachers involved provided estimates of the degree to which these girls were visible to them, known by them and helped by them (Teacher's Estimate of Teacher Concern). The students and teachers also responded to instruments which provided independent criteria for establishing the students for whom the teacher was concerned. A plan to relate teacher effectiveness with individual students to teacher concern for them was not carried out because the necessary data could not be obtained.

When the SETC scores were compared with the teacher's estimate of concern, students who rated the teacher high tended to be those who were rated high by the teacher; likewise, students who gave the teacher low ratings were rated middle or low by the teacher. The teacher's ratings of each student according to visibility related positively to the total SETC and, more specifically, to recognition than to understanding or help. The teacher's estimate of how well she "knew" students related to all dimensions of concern, but was more highly related to recognition and understanding than to help. The teacher's estimate of help given was not related to students' estimates of help.

When independent criteria were compared with the teachers' and students' estimates of concern, the following

positive relationships were found: (1) the amount of information a teacher possessed for each student was related to: a) her estimate of a student's visibility and b) her rating for "knowing" students; (2) a) when social development was the criterion for establishing students "understood" by the teacher, these students rated their teachers higher on understanding and the total SETC than did those students who were "not understood"; b) students designated as "understood" by the foregoing criterion comprised the largest proportion of the group the teacher said she "knew best"; (3) when character development was the criterion for establishing students as "understood," these students rated their teachers higher on recognition, understanding and the total SETC than did those who were "not understood."

The data appear to support a belief that the total Student Estimate of Teacher Concern is a valid measure of concern. Comparisons of the data for each dimension failed to establish that concern, as perceived by students, has three separable components.

Reliability coefficients were: total SETC .96; recognition .92; understanding .85; help .83.

It was concluded that students perceived a teacher's concern for them clearly when students were "visible" to the teacher and when she "knew" them. Information the teacher possessed was more highly related to the teacher's rather than the student's concept of concern. The dimension of recognition appeared to be more clearly defined than either understanding or help.

245 pages. \$3.06. Mic 56-426

SCHOOL AND MUNICIPAL RELATIONSHIPS IN WISCONSIN CITIES

(Publication No. 14,776)

Russell "M" Owen, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor LeRoy J. Peterson

The City School Plan, under which cities of the second and third classes operate in Wisconsin, calls for a school-municipal relationship in a number of specified areas. It is desirable that relations between school and municipal government be harmonious in these areas where statute requires coordination as well as in other areas where coordination is voluntary. Satisfactory relations, however, are frequently difficult to achieve and it is likely that school-municipal relationships are characterized by both harmony and discord. Accordingly, it is the purpose of this study to determine the extensiveness and the quality, as characterized by harmony or discord, of school-municipal relationships in selected Wisconsin cities of the second and third classes. This study also attempts to determine if identifiable characteristics of municipalities and school and city officials seem to accompany harmony and discord in the school-municipal relationship.

An interview instrument was developed to be used in local communities to obtain information concerning the relationship of school government to city government and to record personal characteristics of school and municipal officials. After consultation with the Wisconsin League of

Municipalities and the Wisconsin Education Association ten cities of the second and third classes were selected for study. Five of these cities had an history of harmonious school-municipal relationships and five of these cities had an history of discordant school-municipal relationships. In each of these cities the superintendent of schools, the mayor or city manager, the president of the school board and the president of the city council, and three other board members and three other councilmen were interviewed. Material collected through personal interview as well as material reported by the Wisconsin Department of Taxation, the Wisconsin Department of State Audit and the Wisconsin Department of Public Instruction was evaluated in an attempt to answer the problems of this study.

School-municipal relationships were found to be concerned with the school budget, the school building program, business management, recreation, health and library services, annexation and educational planning. Forty-nine of fifty interviewees of group I cities (discordant relationship) characterized the school-municipal budgetary relationship in their cities as discordant while forty-nine of fifty interviewees of group II (harmonious relationship) characterized this relationship in their cities as harmonious. With respect to school building program relationships eighteen of fifty group I interviewees characterized this relationship as discordant while the group II interviewees were unanimous in characterizing the relationship harmonious. A majority of the interviewees reporting school-municipal relationships with respect to business management, recreation, library and health services, annexation and educational planning characterized this relationship harmonious. In some instances, however, discordant relationships were reported. When characteristics of municipalities and characteristics of school and municipal officials were investigated there was evidence to suggest that harmony in the school-municipal budgetary relationship is related to a relatively low "all purpose tax rate" and a relatively high "normal income tax returned to the municipality".

Evaluation of the data reported in this study admits of the following conclusions: (1) School and city government are in practice related as required by Wisconsin statute. (2) School and city government are voluntarily related in a number of areas not required by Wisconsin statute. (3) School-municipal relationships are predominately harmonious in some cities and are predominately discordant in others. (4) Discord is more likely to prevail with respect to the school budget-estimate than with respect to other areas of the school-municipal relationship. (5) Harmony is more likely to prevail with respect to health services and library services than with respect to other areas of the school-municipal relationship. (6) There is no significant difference at the 5% level between groups I and II cities with respect to the personal characteristics of school and city-officials. (7) There is evidence to suggest that harmony in the school-municipal budgetary relationship is accompanied by a relatively low "all purpose tax rate" based on equalized valuations and conversely that discord in the school-municipal budgetary relationship is accompanied by a relatively high "all purpose tax rate" based on equalized valuations. (8) There is evidence to suggest that harmony in the school-municipal budgetary relationship is accompanied by a relatively high "per capita normal income tax returned to the municipality" and conversely that discord in the school-municipal budgetary

relationship is accompanied by a relatively low "per capita normal income tax returned to the municipality."

261 pages. \$3.26. Mic 56-427

EDUCATION, ADMINISTRATION

IMPLICATIONS OF TRENDS IN RECEIPTS AND EXPENDITURES FOR LONG-TERM BUDGET PLANNING: AN ANALYSIS OF RECEIPTS AND EXPENDITURES FOR TEN YEARS IN THE FIFTEEN VILLAGE SUPERINTENDENCIES IN WESTCHESTER COUNTY, N. Y.

(Publication No. 15,556)

Theodore James Ahern, Ph.D.
New York University, 1955

This study of the receipts and expenditures of the fifteen village superintendencies in Westchester County, New York, analyzes the amounts received and expended in each, through ten years 1944-45 to 1953-54. Current budget formulation and presentation practices of these school systems are examined to determine their relationship to long-term planning. The data relating to these practices were secured from each of the fifteen school superintendents by means of personal interviews and an appraisal questionnaire. The financial data were secured from the published reports of the Bureau of Statistical Services, New York State Education Department and the unpublished reports on school costs compiled by the Scarsdale school system. The total amounts for each year in assessed valuation, receipts and expenditures for each of the fifteen school districts were translated into dollars per pupil in average daily attendance. These amounts were converted to comparable values by use of the Cost of Education Index. This index was devised by Lorne H. Woollatt for the New York State Educational Conference Board.

An arithmetic mean was computed for the categories of the budget for each year for the ten year period. Graphs were prepared to show the trends in actual receipts and expenditures compared with the arithmetic mean and with the 1944-45 figures as corrected by the Cost of Education Index.

The Gompertz Curve statistical method was applied to the current expenditures for the past ten years in one school system to show a typical trend of future current expenditures.

Conclusions drawn from the data were:

1. Present practices in these school systems for budget preparation for the ensuing year may be utilized to advantage in planning a long-term budget.
2. The pattern of past receipts and expenditures, over a period of years, should be considered in budget planning, to a greater extent than the present plan of comparison with current figures.
3. The changing value of the dollar as interpreted by the Cost of Education Index indicates that current expense totals in 1953-54 must be 75.7 per cent

higher than in 1944-45, if the level of the educational program is to be maintained.

4. All categories of the budget lend themselves to prediction by the budget maker for the purpose of long-term planning.
5. A pattern of past receipts and expenditures for a ten year period, as adjusted by the Cost of Education Index, is a more defensible basis of comparison for predictive purposes than that established by the current year's accounts.
6. The procedures used in estimating the contents of a long-term budget are essentially the same as those used for a short-term budget.
7. Current expense categories of the budget may be compared with predicted amounts, as indicated by the Gompertz Curve, to determine any variance from the established pattern of past years.

On the basis of evidence presented in this study, the investigator concludes that a long-term budget can and should be constructed by a school system, to allow the board of education and staff an opportunity to study the future trend of educational policies, and to permit the community to view the sources of receipts and the anticipated costs of the future educational program.

248 pages. \$3.10. Mic 56-428

THE MONEY PROBLEMS OF ADOLESCENTS IN THE SECONDARY SCHOOLS OF SPRINGFIELD, MASSACHUSETTS

(Publication No. 15,539)

A. Martin Bloom, Ed.D.
New York University, 1955

The problem.

The purpose of this study is to identify the money problems of the adolescent in each grade from the 7th to the 12th in four junior and the four senior high schools of Springfield, Massachusetts, to compare the relative frequency with which these financial concerns are presented according to school level, school, grade, academic ability, sex, and socio-economic status, and to indicate how this data can be used in a curriculum improvement program.

Design of the study.

From a survey of literature, suggestions offered by school and bank personnel, and a pilot study, a list of forty-one money problems was drawn up. These problems, in the form of a check list, were divided into five major areas: buying, spending, obtaining, saving money, and problems of a personal nature. In addition to a categorical "Yes" or "No" response, a "This is my problem once in awhile" choice was included. The check list together with a personal data sheet was then printed for distribution.

Three classes from each grade, based on academic ability--high, average, and low--were selected in all of the eight schools. The total sample used in the tabulations consists of 935 senior high and 1038 junior high school pupils.

Warner's Index of Status Characteristics was used for determining a pupil's socio-economic status. However, in this study status is divided into the two major categories--upper class and lower class--because this investigator felt that the differences which exist would be more clearly shown by a comparison of the extremes.

Statistical measures employed.

The data is tabulated for total number and percentage of pupil response on each problem according to the factors of school level, school, grade, academic ability, sex, and socio-economic status. To determine the reliability of the incidence of these pupil problems, the standard error of a percentage is used. Significant pupil differences according to all the factors are shown by the standard error of the difference of a percent and the critical ratio; the 5% and 1% levels of confidence are the criteria applied.

The I.B.M. Electric Punched Card System was employed for tabulating the total number of responses on each problem.

Findings:

A higher percentage of pupils in the junior high schools have financial concerns than those in the senior high schools.

Only about half of the high school pupils feel that the school is providing them with enough information to help them solve most of their money problems.

Adolescents are very much concerned with the problem of obtaining money. Being able to secure part-time work seems to be of utmost importance to them.

Pupils of average and low academic ability have more money problems than those of high academic ability.

Junior high school boys have slightly more problems than girls, while the senior high school boys have many more.

Many adolescents have difficulty in keeping up with school expenses, personal grooming, and feel embarrassed because of lack of funds.

Adolescents with the lowest socio-economic status have the highest average problem score on both school levels.

Because of its pupil composition, each school has some problems uniquely different from the others.

Pupils of low socio-economic status have a greater preponderance of problems which are basically due to lack of money. Upper socio-economic class pupils also have problems but they are of a different character.

Partial list of recommendations:

The school administration can utilize the data in this study to inaugurate a curriculum improvement program by:

1. Establishing an in-service teacher development program in which all the teachers in the subject areas of mathematics, social studies, home-economics, and business education would participate in helping to create a more correlated curriculum. (These subjects have some common elements related to pupils' money concerns.)

2. Using the check list, as developed in this study, periodically to provide valuable information as to the specific money problems which may be affecting a pupil's progress in school.
 3. Having each school examine the direct and indirect effects of its financial demands on pupils.
 4. Instituting a school savings program with regular weekly savings facilities in the high schools.
 5. Initiating a work-study program in the three high schools similar to the program which is being conducted at Trade High School.
- 162 pages. \$2.03. Mic 56-429

BOARDS OF COOPERATIVE EDUCATIONAL SERVICES IN THE STATE OF NEW YORK

(Publication No. 15,487)

Milton Flynn Boyden, Ph.D.
Cornell University, 1955

The study is a survey of the boards of cooperative educational services in the state of New York. It was undertaken in an effort to gain an understanding of the boards, their personnel, and the problems that arise as education is extended by way of shared services.

Questionnaires were sent to the following seven groups:

1. The state education departments of the forty-eight states.
2. The district superintendents who were associated with Boards of Cooperative Educational Services in 1953-54.
3. The presidents of Boards of Cooperative Educational Services.
4. Principals who were working with Boards of Cooperative Educational Services.
5. Teachers who were working for Boards of Cooperative Educational Services in 1953-54.
6. Teachers who had worked for Boards of Cooperative Educational Services prior to 1953-54 but had left to do other work.
7. District Superintendents who did not have Boards of Cooperative Educational Services in their districts in 1953-54.

The statistical technique of chi square was used to determine differences in thinking toward cooperative boards by presidents of cooperative boards, the superintendents, the present teachers, and the past teachers. Differences of opinion that were statistically significant were found concerning the questions pertaining to:

1. Cost of education through the cooperative board programs.
2. The problem of transportation for shared teachers whenever the past teachers were considered.
3. The regular school faculties' feelings toward the cooperative board teachers.

4. Educational services to be handled in the local schools or by a cooperative board as far as the principals and superintendents are concerned.
5. Present and past teachers preference concerning working for one school or for a cooperative board program.

Conclusions drawn from the study were:

1. Favorable attitudes toward boards of cooperative educational services were reported by a majority of all personnel working with them.
2. Although teachers reported that they were in sympathy with the work being done by boards of cooperative educational services and also felt that the boards were furnishing very worthwhile services, the majority of them preferred to teach in one school.
3. Interest, hard work and cooperation of district superintendents and principals of participating schools were considered the most important factors in the success of boards of cooperative educational services.
4. A majority of the superintendents with cooperative boards in 1953-54 felt that the boards were aiding in bringing about administrative units larger than the present supervisory districts.
5. Of the needs that boards of cooperative educational services are authorized to meet, the following were reported as being most needed by principals and superintendents:
 1. Reading specialists
 2. Dental hygienists
 3. Elementary supervisors
 4. Psychiatric psychological services
6. Principals are in sympathy with cooperative boards and are interested in improving the educational facilities of their schools through the boards.
7. Some of the reasons why cooperative boards are not as successful as they should be are:
 1. Problems concerned with transportation for cooperative teachers.
 2. Difficulty in scheduling rooms for cooperative teachers.
 3. Difficulty in scheduling time of cooperative teachers.
8. A high percentage of the teachers who leave boards of cooperative educational services continue teaching in one school.
9. A majority of the teachers who leave boards of cooperative educational services leave for reasons which have nothing to do with the cooperative board programs.
10. It appears that the employment of shared teachers leads to many full time positions in schools participating in cooperative board programs.

11. A majority of all groups concerned with boards of cooperative educational services feel that the boards are highly successful.

314 pages. \$3.93. Mic 56-430

**FLETCHER BASCOM DRESSLAR:
HIS LIFE AND WORKS**

(Publication No. 15,463)

Robert M Cochrane, Ed.D.

George Peabody College for Teachers, 1955

Major Professor: W. D. McClurkin

This study answers the question: What personal attributes and professional accomplishments of Fletcher Bascom Dresslar contributed to his place of honor among our leaders in education? The data upon which the study was based were drawn from Dresslar's official correspondence, the publications and speeches of his professional career, and his casual papers; from interviews with members of his family, former students, and colleagues; and from sources in the literature. Although the study encompassed all the years of Dresslar's life, the report has considered only those aspects of his life that contribute to the problem.

Dresslar was born near Banta, Indiana, September 28, 1858, and grew to manhood in a rural environment such as he was to extoll in his later writing and speeches. He received the Bachelor of Arts degree and the Master of Arts degree from Indiana University in 1889 and 1892, respectively. The degree of Doctor of Philosophy was conferred upon him by Clark University in 1894. In 1892, he married Cornelia Jerauld Welborn who died in 1919. Two sons, Otis Welborn and Oscar Howland Dresslar, were born of this union. In 1923, Dresslar married Minnie Bryant Fisher.

Dresslar's professional teaching career began at the State Normal School, Los Angeles, California, 1894-1897; and progressed through successive assignments in the University of California, 1897-1909; the University of Alabama, 1909-1911; the United States Bureau of Education, 1911-1912; and George Peabody College for Teachers, 1912-1930.

The work at Peabody College gave Dresslar opportunity to emphasize the importance of hygienic school buildings in conserving the health of children and in improving the standards of personal and community hygiene in the South. In his publications and speeches, and in his courses in school hygiene, school planning, rural sanitation, and school building service the implications of the problem for rural areas were emphasized. Dresslar's services as a teacher were characterized by a firm faith in the power of education to help people find improved ways of living, by a devotion to duty, by a broad understanding of the needs of his students, and by his practical approach to the problems of education.

As Special Agent of the United States Bureau of Education, Dresslar was primarily concerned with advising school officials and architects on the planning of hygienic school buildings. In this activity he emphasized cooperative planning and encouraged architects to consider educational function in school building design. Dresslar also

participated in the school surveys conducted by the Bureau of Education and by private agencies.

The professional organizations with which Dresslar was closely identified were the Interstate School Building Service, which he helped organize, and the National Council on Schoolhouse Construction.

Conclusions

Dresslar's influence as a teacher of courses in school hygiene, and as an advisor in problems of planning school buildings was a major factor in the development of school architecture in this country.

His published works on school hygiene and school buildings have had great influence upon educational practices. He made effective use of his skills as a speaker in carrying his message of the need for hygienic school buildings before the public.

Dresslar's most significant professional accomplishment and his most enduring contribution to education was the training and development of the directors of the divisions of schoolhouse planning in the state departments of education in the South.

Throughout the course of his professional career, his accomplishments were motivated and given substance by his faith in the power of education to improve mankind, his devotion to duty as a teacher, his professional integrity, his love of rural life, and his predisposition for practical solutions to educational problems.

162 pages. \$2.03. Mic 56-431

**ACTIVITIES OF PARENT-TEACHER ASSOCIATIONS
IN ILLINOIS DESIGNED TO AID LOCAL SCHOOLS**

(Publication No. 15,212)

Lee George Grebner, Ed.D.

University of Illinois, 1955

The three purposes of this study are: (1) to discover the facts concerning present activities of local PTA's in Illinois; (2) to analyze and interpret those facts and the generalizations drawn from them in terms of their consistency with PTA objectives; (3) to determine the extent to which objectives of the PTA movement are being realized, to suggest areas of needed revision or greater emphasis, and to make general recommendations for the improvement of PTA activities.

The general procedure for achieving these purposes involved a questionnaire type of investigation. Four questionnaires were used, each one designed to obtain specific information concerning a particular phase of the general investigation: (1) a form filled out by local PTA officers giving information on their memberships and activities; (2) a form filled out by individual parent and teacher members giving personal data and expressing opinions concerning the local organization; (3) a form filled out by non-member citizens expressing their points of view on PTA problems; (4) an evaluation form filled out by local officers, or by a committee, giving information concerned with PTA objectives. To provide a specific setting for certain interpretations of the data, the first three of these forms were also used in an intensive study of local units in a particular

mid-state city. Results tabulated from the state as a whole represent a random sampling of PTA units.

While wide variation exists among local PTA's in Illinois in the number and kinds of their activities, the following conclusions apply generally to local PTA units.

1. The membership should be expanded. More men are needed in the organization; fathers, as well as mothers, are concerned with the education and welfare of their children. All, or nearly all, families with children in school should be represented in PTA membership. A true cross-section of the community should be represented; PTA work should have no special appeal to, or discrimination against, a particular group. Most basic in expanding the membership is the necessity for a program of activities consistent with PTA objectives.

2. Wider participation by members should be obtained. The PTA program is effective to the extent that the interests and abilities of all its members are utilized in carrying out its activities. Opportunities for member participation are many: standing committees, special committees, study groups, discussion meetings, and special projects. Members voice the criticism that a few have to do all the work. If the work involves, not irrelevant tasks, but the improvement of education and welfare of children, it is doubtful that parents and teachers would remain indifferent.

3. More time should be spent on activities consistent with PTA purposes, and less time should be spent on activities unrelated to PTA objectives. The PTA is not a money-making organization. It is not a social group, nor are meetings held for the serving of refreshments. PTA meetings are not largely business meetings. The PTA is not an organization dedicated to the purchasing of school equipment. All of these activities should be examined in terms of their contribution to the objects and policies of the PTA. If the PTA is an educational organization, it should spend its time and effort on educational activities. Extraneous pursuits should be relegated to their appropriate places in the over-all PTA program.

4. The PTA should be more aggressive in undertaking a wider variety of activities. Perhaps the reason for its apparent lack of aggressiveness is the high degree of uncertainty and disagreement in the minds of its members concerning what the PTA should or should not do. Clarification and consensus at the local level must be reached through group discussions by parents and teachers. PTA objectives should be analyzed and activities agreed upon which are consistent with those objectives.

235 pages. \$2.94. Mic 56-432

**REDISTRIBUTION OF TIME ALLOTTED TO
ACADEMIC SUBJECTS IN SECONDARY SCHOOLS:
AN EXPERIMENT IN INCREASING HOURS OF
CLASSROOM WORK IN CERTAIN SUBJECTS, AND
DECREASING THE HOURS IN CERTAIN OTHER
SUBJECTS, WITH THE OBJECTIVE OF GAINING AN
INCREASED NET MEASURABLE ACHIEVEMENT
BY THE PUPIL**

(Publication No. 15,571)

Sidney Percy Marland, Jr., Ph.D.
New York University, 1955

The Problem

The increasing demands upon the public secondary schools for broadening their services and their curriculum content impose an obligation to scrutinize the time that is being spent in the conventional program on all academic subjects, to determine whether such time is being effectively used in terms of pupil growth. Tradition and convenience, together with the profound influence of the Carnegie Unit have dictated that all academic classes shall meet five times per week for the conventional period of forty to sixty minutes.

Specifically, the problem is whether time can be decreased in one subject and added profitably to another, with no measurable loss to the subject, the time of which has been reduced.

Background

For some years the pupils in the seventh and eighth grades of Darien Junior High School, Darien, Connecticut, had been achieving consistently high median scores in arithmetic standard testing. The pupils reflected a need for improved reading rate, not only in the grades concerned, but in the subsequent grades in the high school.

The Experiment

After considerable staff deliberation the decision was made to redistribute the time being devoted to arithmetic and English (in this case reading rate). The teachers of mathematics agreed, with some misgivings, to teach mathematics for four days each week, and to devote the fifth day to reading rate instruction.

Following a one year pilot study during 1953-54, a formal experiment was launched in September, 1954. A control group consisting of approximately one half the class sections of grade seven was designated to pursue the conventional five-day-a-week program. Experimental groups, consisting of the remaining seventh graders and all eighth graders were established to pursue the "redistributed" program, allowing four days each week for arithmetic and devoting the fifth day to reading rate drill.

At the beginning of the year all pupils were administered arithmetic and reading rate comprehension tests to determine their starting point. The control group in grade seven was equated with the grade seven experimental group at the start of the experiment. The groups were found to be well matched in all subjects and in ability.

The Findings

After a year of redistribution of time, all groups were tested again. The results in the equated groups were found to have a very high t-value for significant difference in reading rate in the experimental groups. The median reading rate increase of the seventh grade experimental group (91.5 words per minute) was more than double that of the control group (39.9 words per minute). The increase in grade eight totaled 116 words per minute for the two-year period, compared with an assumed doubling of the control group increase to 80 words per minute.

There was slightly greater achievement in mathematics for the seventh grade experimental group than for the control group. The comprehension check produced higher results in both experimental groups than in the control group.

The teachers of mathematics, in general, reflected endorsement of the program with some recommendations for modification.

Conclusions

The findings suggest that time can be effectively reduced in one subject, without measurable loss in pupil achievement, and can be profitably devoted to another subject.

There is evidence that the conventional program of equal time for all academic subjects is wasteful. The Carnegie Unit, insofar as its implications affect grades seven and eight, is based on a false premise.

The extension of this investigation into the academic subjects of the conventional high school is necessary before a firm claim can be made that the Carnegie Unit is wasteful of pupil and teacher time at this level.

192 pages. \$2.40. Mic 56-433

LEGISLATIVE CONTROL OF TAX-SUPPORTED COLLEGES FOR THE EDUCATION OF TEACHERS

(Publication No. 15,469)

Thomas Bradford Metcalf, Ed.D.
George Peabody College for Teachers, 1955

Major Professor: William H. Vaughan

The purpose of this study was to examine the current constitutional or statutory provisions enacted by the various states concerning the control of tax-supported colleges for the preparation of teachers in order to reveal the prevalent practices or the types of control which govern the public-supported institutions for the education of teachers.

In order to comprehend fully the various forces which control the state supported colleges for the education of teachers, an extensive study of the evolution and development of the state teachers college movement was undertaken.

Copies of the state constitutions, statutes, and specific information pertaining to the governing boards of tax-supported colleges for teacher education were obtained

from the facilities of the Vanderbilt Law Library or the forty-eight chief state school officers.

The data unfolded eight distinct areas of control: the legislature; the governor and such state officials as the lieutenant governor, secretary of state, state treasurer, attorney general, and the chief state school officer; the state board of education; state teachers college boards; unified state boards for all higher education; separate state boards which control the tax-supported colleges for teacher education; and central state coordinating boards.

The tax-supported colleges for teacher education investigated were selected from two sources: first, the master list of state institutions published in 1952 by the Council of State Governments in Higher Education in the Forty-Eight States; and second, the 1954 Membership List appearing in the Seventh Yearbook of the American Association of Colleges for Teacher Education. Schools, colleges, and departments of education of state university systems were excluded from the investigation.

Findings and Recommendations

A knowledge of the historical background of the development of the teacher college movement with its chronological augmentation of legal control is essential to comprehend the current operational structure of the public-supported teacher education institution.

At present the legislature is unquestionably the most important control agency in higher education, for it may establish or abolish a state institution of higher learning; create, alter, or eliminate state boards which control these colleges and universities; design commissions or positions for the management of funds, lands, or purchasing for the state institutions; prescribe educational duties, functions, and courses of study; delegate powers to governors or other state officials to supervise and control budgets; and approve or disapprove appropriation measures for the tax-supported institutions of higher education.

The appointive power granted to the governors of the forty-eight states and extending them ex officio membership on boards of control have made these chief state executive officers important and influential educational authorities. They influence significantly the extent and scope of higher education in America. Other key state officials, such as the lieutenant governor, secretary of state, attorney general, and state treasurer, are gradually being excluded from educational functions.

The legal authority extending ex officio membership to chief state school officers on governing boards for teacher education institutions reveals the need for an examination and evaluation of such representation in determining the policy-making control of tax-supported institutions for the preparation of teachers.

As indicated by the findings of the study, there exists a need for unifying the state institutions for teacher education under a single governing board, so as to further the development of the teacher education program.

408 pages. \$5.10. Mic 56-434

AN HISTORICAL STUDY OF THE ORIGIN AND GROWTH OF THE ESSEX COUNTY, NEW JERSEY VOCATIONAL SCHOOLS: A STUDY OF THE RELATIONSHIPS BETWEEN THE SOCIO-ECONOMIC CONDITIONS IN A COMMUNITY AND A SYSTEM OF COUNTY VOCATIONAL SCHOOLS WITH ESPECIAL EMPHASIS ON AN ADJUSTED PROGRAM OF VOCATIONAL EDUCATION

(Publication No. 15,573)

George W. Morgenroth, Ph.D.
New York University, 1955

Chairman: William P. Sears

The purpose of this study was to trace the origin and growth of the Essex County Vocational Schools from 1915 to 1952. The study presents a record of the controlling socio-economic factors, development and growth of the school theory and practice, and the identification of trends and their relationships to the future role of the schools in the community.

The study of the origin, development, and growth of the Essex County Vocational Schools is basic to an adequate understanding of the history, the present status, and the future role of this type of education in Essex County. It is also appropriate because these schools are considered pioneers in the field of vocational education and stand out as good examples of a county system of an area vocational school program.

The period of the study, from 1915 to 1952, includes many significant events which produced changes in the lives, education, employment and thinking of the people of Essex County. During this period, local business and industry became aware of the importance of vocational education, and especially the Essex County Vocational Schools, in the preparation of their employees. They have learned to depend upon the schools to supply the needs for both skilled and technically trained workers. Business and industry, during the period, made definite changes in their products, methods, and systems. These changes have affected the program of the schools. However, the schools themselves made radical changes. These include the change from a two-year trade school to a vocational-industrial and vocational-technical high school and the inclusion of an adult technical school program on a post-high school level. The study attempts to show the progress and continuing nature of the growth of industrial development in all its phases in the county as well as the development of the programs and practices in the vocational schools.

The historical method of research was used to gather data pertaining to: (1) the socio-economic conditions in Essex County during the period and to identify significant trends and their relationships to the school program; (2) to identify local, state, and federal legislative acts and laws pertaining to public vocational education in the county; (3) to trace the origin and development of the county vocational schools; analyze studies, surveys and reports made concerning these schools; and examine the existing programs pointing out the changes that have taken place and the reasons for these changes.

The data obtained were treated in narrative and tabular form according to the chronological order of events and the progress and changes occurring in both the industrial development and the growth of the schools. For the study

of the socio-economic conditions of the county, emphasis was placed upon the changes in population, the educational opportunities, the industries, employment, wages and earnings of the people, the youth of the county and their opportunities for the future. From these, together with the study of the development and growth of the schools, significant trends, developments, and implications emerged which will have a definite effect upon the future of vocational education in Essex County.

These trends were analyzed and studied and the findings checked through consultation and discussion with industrialists, lay citizens, school board members, educators, staff and faculty personnel and alumni of the schools. The resulting findings culminating in a series of recommendations and suggestions which are presented and which should prove valuable in connection with the future planning of new courses and in the adjusting or modifying of the existing instructional programs.

271 pages. \$3.39. Mic 56-435

POLICY INTERPRETATION RELATED TO LEVELS OF ORGANIZATION IN A CITY SCHOOL SYSTEM

(Publication No. 15,354)

Joseph Leonard Scott, Ed.D.
Stanford University, 1955

This study describes how policy interpretation may change as the policy is transmitted successively through the various levels of an organization and identifies some of the various factors which may influence such change. The study was conducted in a rapidly expanding, American city with a population of approximately 708,000 people.

Exclusive of the superintendent of schools, there are three categories of participants in the study. In order of remoteness from the superintendent's position, they are the central staff (superintendents, directors, and supervisors), the school staff (principals), and the teaching staff. A random sample of the participants was chosen from the school staff and the teaching staff. All in the central staff were included. Approximately 75 per cent of all personnel approached made returns.

The investigation tested three hypotheses:

1. That policy interpretation will approximate or deviate from the interpretation of the superintendent as the individual's position in the hierarchy is near to, or remote from that of the superintendent.
2. That the interpretation of a policy statement or directive will be more accurate (using the superintendent's interpretation as a criterion) when the individual agrees with the policies than when he disagrees.
3. That policy interpretation by individuals will approximate or deviate from the interpretations of the superintendent as the individual's orientations and interests approximate or deviate from the orientations and interests of the superintendent.

Data relevant to the hypotheses were collected through the use of a specially constructed Policy Instrument. Part I of this instrument was used to determine degree of accuracy of interpretations (reliability .903); Part II was used to determine degree of agreement with the policies (reliability .917). The Allport-Vernon-Lindzey Study

of Values was used to determine general interests and orientations. Data were analyzed with respect to the accuracy of policy interpretation, agreement-disagreement with the policies, and variation on each of the six scales of the Study of Values.

With respect to the first hypothesis, the findings show that the interpretation of the policies tended to become less accurate as the individual's position and the position of the group to which he belonged became more remote from the superintendent. The two remote categories (school staff and teaching staff) were not significantly different in the accuracy of policy interpretation. Pairing the central staff (category closest to the superintendent) with either of the more remote categories produced differences which were significant.

With respect to the second hypothesis, the findings show that, for individuals, the accuracy of policy interpretation is associated with agreement with the policies. For all personnel categories combined the correlation (r) is .305, which is significant at the .001 level. For the categories considered separately, accuracy of policy interpretation was associated with agreement with the policies in all instances except the school staff.

With respect to the third hypothesis, the findings indicate an association between accuracy of policy interpretation and the aesthetic and social values of the Study of Values. For the aesthetic value, r is .318 ($P < .001$). For the social value r is .218 ($P < .002$). For each of the other values: theoretic, economic, political, and religious, the r 's are not significant. The findings support the hypothesis that, as general interests and orientations of individuals are less differentiated from those of the superintendent on the aesthetic and social values, individual policy interpretation approximates more closely the superintendent's interpretation. 144 pages. \$1.80. Mic 56-436

EDUCATION, ADULT

AN ANALYSIS OF THE FUNCTIONS AND TRAINING NEEDS OF INDUSTRIAL SUPERVISORS

(Publication No. 15,336)

Andrew Charles Luff, Ed.D.
Bradley University, 1955

The purpose of this study was to analyze the functions and training needs of industrial supervisors to ascertain (1) what emphasis should be placed on instructional units designed primarily for individuals seeking a career in industrial supervision, and (2) to make available to individual companies, supervisory personnel, and other interested individuals an analysis of functions performed and training needed by supervisors as differentiated by various selective criteria.

To achieve the objectives of this problem, a letter was sent to various interested individuals asking them to submit lists of the duties, responsibilities, and training needed by industrial supervisors with whom they had close contact.

From the lists which were submitted, a questionnaire

was prepared. This questionnaire was sent to 1,172 supervisory personnel throughout the State of Michigan. Of this number 894, or 76.4 percent, were returned. The respondents to this study represented thirty-three different companies engaged in seven types of industries.

In order to analyze the duties and responsibilities of supervisors, thirty-five functions were submitted to industrial supervisors for appraisal. The supervisors were asked to check these functions: first, to indicate whether they performed the function, and second, to indicate the importance they attached to each function.

To secure a more complete picture of the educational program required, the supervisors were requested to indicate whether or not training of the kind outlined in the questionnaire should be provided. Twenty-one training items were submitted for appraisal. The respondents were asked to indicate the importance they attached to each item.

An item analysis was prepared for each function. These item analyses gave a measure of the relative extent to which each of these functions were performed and provided an indication of the importance which was attached to each of them.

An item analysis was prepared for each item of training needed by industrial supervisors. An analysis was also made of the importance attached to the various items of training by the respondents.

The selected criteria used in this study are:

- Level of supervision
- Years of experience as a supervisor
- Number of employees supervised
- Size of company (employees)
- Regular supervisory meetings
- Union status of workers
- Age of supervisors
- Formal education (grade level)
- Special training

The functions which are most generally performed and may be considered most important are:

- Issuing instructions and orders
- Training people
- Improving morale
- Smoothing out misunderstandings
- Carrying out instructions

The items of training which are most generally needed and may be considered most important are:

- Training in the principles of employee-employer relations
- Training in the psychology of human relations
- Training in the duties and responsibilities of a foreman
- Training in the underlying causes of labor problems
- Training in writing reports
- Training in industrial safety
- Training in first-aid procedures
- Training in the basic principles of speech

182 pages. \$2.28. Mic 56-437

EDUCATION, HISTORY

SCHOOL FORESTS OF NEW YORK STATE, THEIR
NUMBER, LOCATION, SIZE, ORIGIN,
DEVELOPMENT AND USE

(Publication No. 15,494)

Joseph Bernard Kazlauskas, Ph.D.
Cornell University, 1955

This study was an attempt to learn the number, size, origin, development, present uses, and potential uses of school forests in New York State. The school forests considered were those available to the public schools by ownership, or permission of the owners.

The findings were based upon (a) a review of the literature, (b) questionnaires returned by the principals or supervising principals from 95.1% of all the high schools and central schools in the state, (c) questionnaires returned by selected elementary school, general science, and biology teachers located at schools with school forests, and (d) visits to twenty-three schools owning school forests. The determination of forestry practices applicable to, and used in the various school forests was within the realm of this study provided that the practices were related to an all school program. The specific technical aspects of forestry management considered by the vocational agriculture departments were not included in this study.

The establishment and development of school forests in this state have been encouraged by the State Conservation and State Education Departments since about 1920. Where school forests have been established, this has usually been brought about by the efforts of a single interested individual at the particular school. More often than not this individual has been the vocational agriculture teacher. In many cases the departure of the individual from the school system has caused the area to be left unused.

A total of one hundred and fifty-seven school owned school forests were reported. These were distributed throughout the state. They covered a total of about 4,150 acres. The different areas ranged in size from 1/8th of an acre to 361 acres. Different types of trees were represented: (a) mixed second growth hardwoods, (b) softwood plantations, and (c) second growth hardwoods and softwood plantations. Some of the areas had developments in the forms of fireplaces, lean-tos, nature trails, picnic tables, ponds, signs, and toilets. These areas have been used by the different schools for purposes such as: (a) forest management demonstrations, (b) Christmas tree production, (c) pole production, (d) timber production, (e) nature study hikes, (f) picnicking, (g) camping, and (h) conservation workshops.

Most of the school forests were found to be used very little. The majority of the principals and supervising principals were not very strongly inclined towards school forest ownership. They did indicate that they felt a school forest could be used by all levels of the public schools for a variety of classes.

The selected group of teachers contacted indicated that they were using the school forests at their schools to perform only a small percentage of the activities which they felt applicable to the areas. Only 21.3% of the selected group of teachers indicated that they had had any outdoor experiences during their undergraduate preparatory programs. Many teachers were not using the school forests

available because they had not had any experiences in the use of the outdoors.

The degree of use of school forests was found to be related to the ability of the teacher to make use of other available outdoor resources. The teachers who were most likely to make use of them were those who had had outdoor experiences in their coursework, or extracurricular activities. The field experiences which teachers in this state may have had as undergraduates are being supplemented on the postgraduate level by conservation workshops sponsored by teacher training institutions. These workshops are serving to encourage the greater utilization of existing school forests, and may lead to the development of more school forests in the future.

188 pages. \$2.35. Mic 56-438

A HISTORY OF SAINT MARY'S INDUSTRIAL SCHOOL
FOR BOYS OF THE CITY OF BALTIMORE,
1866-1950

(Publication No. 15,484)

Cyril Marcel Witte, Ph.D.
University of Notre Dame, 1955

The problem: St. Mary's Industrial School for Boys of the City of Baltimore was founded in 1866 and closed in 1950. Combining the functions of reformatory, orphanage, foster home, boarding school, and vocational school, it served more than 20,000 boys. No detailed treatment of its origin, operation, and achievement is found in the literature.

It was established to meet a need which continues beyond its closing. Its history consequently possesses a two-fold value: it reveals a problem which was acute a century ago. In revealing the answer to that problem it presents a second value: a pattern and example to those who today face the same problem. St. Mary's sought to prevent and remedy juvenile delinquency by assuming the educational responsibilities of family, church, and state for those boys deprived of the normal influences of these three societies. If it had been an experiment which had failed, its historical value would be severely restricted. But as a successful experiment which changed hypothesis to fact it merits consideration in the history of education.

Sources of data: In developing a history of this institution, official reports and documents, letters, diaries, and scrapbooks of individuals immediately associated with the school, and interviews with persons who had served the school furnished primary source material, assuring the veracity of the history. Secondary sources were utilized for background and confirmatory information.

Organization of dissertation: A chronological presentation of the development of St. Mary's furnished a background from which a topical presentation of the major aspects of the school was more fully developed. The second division of the thesis consequently considered the organization and administration, the educational program, and the activities program of the school.

Findings: The study revealed that St. Mary's was outstanding in many respects: it successfully combined the functions normally found in several different institutions; it gave concrete evidence that state and church could

cooperate in education harmoniously and effectively; it presented a pre-eminently successful educational and vocational training program; it manifested the supreme importance of a religious atmosphere.

In the variety of activities comprising the school program, excellence was characteristic. Vocational training was practical, enabling boys to procure employment immediately upon leaving school. The academic program possessed standards whereby the students compared favorably with ordinary schools. Recreation was highly organized, with an athletic program consistently producing champions. Music contributed fame to St. Mary's and culture to its boys.

St. Mary's was characterized by a progressive spirit. As society changed, as new demands arose, new techniques and activities were introduced. This progressive spirit was carried to an extreme in the modification of admission policies in 1937 and 1938. This reduced the activities of the vocational program with a consequent reduction in income. Boarders who had comprised approximately half the enrollment and contributed substantially to the income were refused. It became necessary to seek complete financial support from the state. This was denied in 1949.

Although the school had been opened in 1866 with enthusiastic support from the archdiocese and had operated with that support through the reigns of Archbishop Spalding, Cardinal Gibbons, and Archbishop Curley, it closed under Archbishop Keough with the archdiocese - clergy and laity - indifferent to its closing. While reports of the city and state officials who visited St. Mary's annually had been unanimously laudatory, the public knew little about its closing, and the public press, once its ardent champion, was strangely quiet.

Its closing terminated eighty-five years of devotion by the Xaverian Brothers to needy boys, a devotion which bore fruit in the reclamation of approximately ninety-five per cent of boys who came there as juvenile delinquents.

351 pages. \$4.39. Mic 56-439

EDUCATION, PHYSICAL

PROGRESSIVE CHANGES IN THE PHYSICAL FITNESS OF AN ADULT MALE DURING A SEASON OF TRAINING FOR COMPETITIVE SWIMMING

(Publication No. 15,218)

William Wilder Heusner, Jr., Ph.D.
University of Illinois, 1955

PURPOSE This study was undertaken to determine the progressive changes in the physical fitness of an adult male during a season of training for competitive swimming.

METHODOLOGY One former Olympic swimmer, who had been sedentary for eighteen months, was measured monthly nine times on 256 test items. The subject trained intensively six days a week, for eight weeks of land work and fifteen weeks of pool work. Extraneous factors were controlled as carefully as possible. A complete tabulation of all raw scores was made. The progressive values observed in each

variable were graphed in terms of raw scores and, if possible, standard scores. The significance of the changes observed was evaluated by use of the standard error of a difference for the case in which the two standard deviations are alike, the sign test, and the standard deviation of an individual on a series of retests taken under normal conditions.

FINDINGS Group generalizations can not be drawn from this study; however, the training program had specific effects on the physical fitness of the subject studied.

Physique 1. Significant increases occurred in the chest girths and chest breadth during training. Chest expansion improved 18 standard scores (S.S.).

2. Adipose tissue was reduced during the land drills. Total fat improved 17 S.S. After swimming started, the initial loss was regained.

3. Calf girth increased 10 S.S. during the land drills.

Organic Fitness 1. The greatest gains were made in the metabolic measures taken with all-out exercise. Large increases were found in the oxygen intake measures. Gross O_2 intake (l./min./kg.) in the all-out treadmill run improved 41 S.S. The magnitude of the oxygen debt during all-out exercise increased; the rate of debt decreased. Net O_2 debt (l./kg.) in the one minute static swim at maximum effort increased 42 S.S. The subject's ability to use total oxygen in all-out exercise increased. Net total O_2 (l.kg.) in the static swim gained 38 S.S.

2. The blood measures showed the next largest changes. An increase occurred in the RBC before and after the treadmill run. The gain in the pre-exercise data was 37 S.S. The RBC after the run was consistently higher than before the run. An initial decrease was observed in blood Hb before and after exercise. A drop of 40 S.S. occurred in the before data. There was a slow return to the initial level in both measures after test period 4 (T_4). The Hb after the run was higher than before. The Hb per erythrocyte Hb/E decreased (25 S.S. in the pre-exercise data) early in training. The Hb/E values after the run were lower than before. The size of the Hb/E change during the run was not affected by training. Low resting blood pH values were found after T_4 , but there was no association with training. Blood pH after the run decreased 45 S.S. A correlation of $r = -0.87$ was found between the time of the run and the blood pH after the run. The correlation between the time of the run and the pH decrease during the run was $r = 0.88$. The WBC before the run increased 32 S.S. An exercise-induced physiological leukocytosis was shown by higher values of the WBC after the run. The resting granulocytes and agranulocytes increased in proportion to the WBC; the latter were largely responsible for the observed leukocytosis during the run. The total plasma proteins before and after the run dropped (62 S.S. in the before value) between T_1 and T_2 . After T_2 , there was a gradual rise. The values after the run were higher than before.

3. The systolic amplitude of the heartograph improved 14 S.S.; The diastolic surge and the obliquity angle, 30 S.S.; and the rest to work ratio, 40 S.S.

4. The electrocardiograph R wave amplitude increased

29 S.S.; the T wave, 11 S.S.; and the Q wave, 0.6 mm. The S-T segment was elevated 1.3 mm.

5. The pulse rate and blood pressures were fairly consistent in their responses to training. All of the quiet pulse rates decreased. The lying pulse rate was lowered 30 S.S. between T_1 and T_3 . The lying and standing systolic blood pressures were reduced 22 S.S. and 15 S.S., respectively, in the land drills, but increased in the pool drills. The lying and standing diastolic blood pressures increased 17 and 24 S.S., respectively, reaching maximum values at T_7 . There was an increase of 13 S.S. in the mean lying blood pressure and a decrease of 25 S.S. in the lying pulse pressure near the end of training. At T_1 , the diastolic pressure one minute after the run was 108 mm. Hg.; at T_8 it was 80 mm. Hg. The effect of training on the diastolic pressure after exercise occurred more quickly in the run data than in the swim data. The systolic pressures taken one minute after the swim and one minute after the run increased, as did the pulse pressures. There was little similarity of variance between the sphygmomanometer and heartometer blood pressures.

6. Most of the indices computed from pulse rate and blood pressure measurements before and after exercise showed associations with training. Improvements of 26 S.S. in the 5 minute step test, 22 S.S. in the pulse rate condition index, 20 S.S. in the Schneider Index, and 11 S.S. in the Barach Index were found. The intensive conditioning program had more of an effect upon the adjustments made to hard work than upon those made to light work. In the progressive pulse ratio test, the total 2 minute pulse count after 36 steps per minute improved 17 S.S.; after 12 steps per minute, it improved only 11 S.S. There was improved work efficiency at all levels.

7. Gains were made in expiratory force (38 S.S.) and in breath-holding (24 S.S.).

8. The frontal area and the long diameter of the diastolic heart X-ray showed reductions of 34 S.S. and 23 S.S., respectively. The depth of the heart increased slightly (12 S.S.). Heart volume decreased. The Nylin Index, the ratio of the heartometer area to the frontal area of the heart X-ray, and the ratio of the heartometer area to heart volume all showed that heart function was improved with training.

9. There was a statistically insignificant increase of 12 S.S. in B.M.R. The R.Q. of the subject was consistently lower than average.

10. Stroke volume before and after exercise increased. Values computed from data taken after exercise improved more and were consistently higher than quiet values.

11. Exercise was found to lower peripheral resistance (W) while raising the rigidity to resistance ratio (E/W). A gradual decrease in W was observed with training.

Motor Fitness 1. The greatest improvements occurred in the muscular endurance items. Large initial gains were made, with maximum values above the 100 S.S. level recorded at T_4 . Swimming maintained a high degree of muscular endurance.

2. There were slight decreases in strength during the land drills. Large gains were made after pool drills began. Total strength increased 31 S.S. from T_3 through T_7 .

3. The subject improved 20 S.S. in the agility 4-count exercise from T_1 to T_5 ; after T_5 , no changes were observed. A gain of 5 S.S. was made in the Illinois agility run.

4. There was a loss of 18 S.S. in visual-auditory reaction time between T_1 and T_2 .

5. The power of the subject increased an average of 16 S.S. during training.

6. Flexibility decreased during land drills, but improved when pool drills started.

7. Balance improved 12 S.S. as measured by the squat stand.

Pool Tests 1. Gains of over 40 S.S. were made in each of the 100, 220, and 440 yard swimming tests. Peak sprint performances were achieved one month before the best endurance performances.

2. A gain of 3.9 sec. was made in the 100 yard drop-off swim test during the swimming part of the training program. The drop-off index improved 1.9 sec.

3. Losses of 15 and 12 S.S., respectively, occurred in horizontal floating capacity and in buoyancy during the swimming part of the training program.

4. Slight improvement in swimming coordination was noted. 486 pages. \$6.08. Mic 56-440

EDUCATION, PSYCHOLOGY

DISCRIMINATION AND ASSOCIATION TRAINING IN MORSE CODE RECEPTION

(Publication No. 15,177)

Henry Lamar Adams, Ph.D.
University of Illinois, 1955

A theoretical examination, based on associationistic concepts, of the learning processes involved in Morse code reception led to the assumption that these processes might be better understood when discrimination was distinguished from association. Further, it appeared that discrimination might be the more important process in paired-associate learning situations that involve stimuli (such as Morse code signals) which are frequently confused.

It was hypothesized that discrimination among code signals during initial learning would be facilitated by analytic attention to the "di-dah" components of the signals, but that this analytic attention would interfere with code learning at higher speeds (from about 10 words per minute) because at higher speeds signals must be perceived as "wholes." This attention to the components of the signals was expected to result from a training procedure in which overt verbalizations of the "di-dah" components by the instructor would supposedly foster implicit verbalizations by the students. It was expected that students of lower code aptitude would be especially affected by this verbalization training procedure. Combining these predictions

into a general statement, the principal hypothesis of this study was that verbalization training would be superior at low code speeds and inferior at higher code speeds, especially for students of lower code aptitude.

When tested in a laboratory experiment, this *a priori* hypothesis was not supported. Differences between test scores after initial training for "Verbalization" subjects and "Non-Verbalization" subjects were unreliable. Differences between scores at the criterion speed of 12 words per minute were also unreliable. However, these scores were in the predicted direction at both the initial and final stages of training, and the performance curves for the two groups crossed between 10 and 11 words per minute.

These facts led to the formulation of an *a posteriori* hypothesis that verbalization training is helpful at low code speeds and harmful at higher code speeds when both initial and final performance are taken into account, as would be indicated by the presence of significant interaction between initial and final performance scores. This *a posteriori* hypothesis was supported. It was suggested that a larger-scale comparison under standard classroom conditions might be desirable. If non-verbalization training proved to be at least as good as verbalization training, the cumbersome extra operation of verbalizing might be dropped.

Two minor hypotheses were also tested in this study. The first was developed in an attempt to provide students who are training at moderate or high code speeds with prompt knowledge of the correct responses in such a way that practice would not be frequently interrupted for confirmation. It was hypothesized that guidance (by printing some of the letters on the practice sheets) combined with delayed confirmation would be superior to delayed confirmation alone. This hypothesis was not supported. It was suggested that, since a satisfactory method of training at moderate and high code speeds is badly needed, some different combination of guidance and confirmation techniques might be tested in another experiment.

The second minor hypothesis stated that, after practice and testing at a given speed, (a) scores on a test at the next lower speed would be higher than the scores on the test at the practice speed, and, conversely, (b) that scores on tests at the next higher speed would be lower than the test scores at the practice speed. This hypothesis was supported. It was suggested that some testing at speeds lower than those of practice might improve the motivation and morale of students who are having difficulty.

77 pages. \$1.00. Mic 56-441

FACTORS RELATED TO THE FAVORABILITY OF CHILDREN'S PERCEPTIONS OF THEIR TEACHERS

(Publication No. 15,199)

Raymond Lewis Debus, Ph.D.
University of Illinois, 1955

Previous studies of teacher-pupil relationships and interaction have produced significant findings concerning behavioral and attitudinal differences between groups of pupils experiencing different patterns of teacher behavior. These studies have not generally taken into account differences within class groups. The present study focuses primarily on hypotheses relating to within class differences

in the favorability of children's perceptions of their teachers.

In clarifying the nature of the study and outlining the types of variables involved, a conceptual model of teacher-pupil perception and interaction was proposed. Three types of hypotheses were advanced: (I) Predicted relationships between pupil favorability toward the teachers and variables of (a) differential teacher behavior, (b) teacher evaluation of individual pupils on various criteria and (c) various pupil characteristics; (II) hypotheses concerning pupil "cognitive motivation" and "cognitive value orientation" and their relationships to other aspects of classroom interaction; (III) second-order hypotheses in which the nature and extent of relationships between two variables were predicted to vary as a function of differences in teacher attitudes or in the class mean favorability toward the teacher (i.e., the within-class relationships related to between-class differences).

The subjects of the study were the 20 teachers and 556 pupils in 20 fifth- and sixth-grade classes, selected by stratified random sampling from among 56 classes of this grade level in the school system of a midwestern city with a population of approximately 65,000 people. Data concerning the variables were obtained by use of various paper and pencil tests which were administered to class groups on two successive school days. Pupil scores on all these measures were subsequently correlated within each of the 20 groups, and these correlation coefficients were the basic data used in the testing of the study's major hypotheses.

Relationships were found in a significant proportion of classes between the dependent variable and (a) teacher approval-disapproval behavior, (b) teacher evaluation of the pupil's personality and school behavior and (c) the following pupil characteristics: school achievement, sex, favorability-unfavorability of perception of previous teachers, extent of parent-child conflict, adjustment and "general attitude toward the external environment." Although pupil socio-economic status bore no consistent relationship to pupil favorability toward the teacher, it was found to be significantly related to the teacher's approval behavior. Alternative interpretations of these findings were considered and discussed.

In a subsidiary phase of the study, the variables "cognitive motivation" and "cognitive value orientation" were demonstrated to be empirically independent. Pupil "cognitive motivation" was found to be significantly related to pupil favorability, but hypotheses advanced concerning "cognitive value orientation" were not supported.

Predominantly negative findings were obtained for hypotheses relating to second-order relationships. Teachers with high and low MTAI scores could not be differentiated in such behaviors as their approval-disapproval behavior and its relation to other variables, or the accuracy of their social perception. Teacher MTAI score showed negligible correlation with class mean pupil favorability toward the teacher. Negative results were also found for most hypothesized second-order relationships as a function of class mean pupil favorability toward the teacher. However, within the classes of the more favorably perceived teachers, there was a significantly higher correlation between pupil favorability toward the teacher and pupil socio-economic status. Further, there was a significant tendency for classes with favorably perceived teachers to show high mean cognitive motivation.

Since this was a correlational rather than an experimental study, definitive interpretations of many findings were not possible. The findings of this investigation do, however, indicate relationships that should now be submitted to experimental attack. Suggestions are made as to fruitful lines for each experiment. Finally, some of the educational implications of the findings of this study were discussed. 186 pages. \$2.33. Mic 56-442

AN EXPERIMENTAL ANALYSIS OF THE EFFECTS OF VERBAL PRAISE UPON PUPILS CLASSIFIED AS "MALADJUSTED"

(Publication No. 15,448)

Joseph Gordon Dollins, Ed.D.
The University of Oklahoma, 1955

The purpose of this study was to attempt to discover what effect systematic praise, as a partial reinforcement, given for an activity which was presented as a regular part of the classroom procedure, would have on: (1) The social and emotional adjustment of maladjusted children as measured by a psychometric instrument, and (2) the accuracy and work output of maladjusted children in the task of arithmetical computation involved in the addition and subtraction of two column, two digit numbers.

Specifically the problem included 404 fourth grade pupils from nine elementary schools in Oklahoma City and three elementary schools in Norman, Oklahoma. From these twelve schools, 129 pupils were selected as "maladjusted" on the basis of having scored at, or below, the thirtieth percentile on the California Test of Personality; Elementary Form AA. These 129 pupils were randomly divided into two experimental groups and a control group. Experimental Group I received praise two-thirds of the time for performance on an arithmetic task consisting of seventy-two problems of addition and subtraction of two column, two digit numbers on which the pupils worked for three minutes. Experimental Group II received praise one-third of the time for performance on the same task and the Control Group received no praise at any time for like performances. The study ran for thirty school days or about six weeks.

At the end of three weeks the groups were tested again with an alternate form of the California Test of Personality and cumulated arithmetic scores were recorded. At the end of the six week period the original form of the personality test was given and cumulated scores for the six weeks were tabulated.

Results of an analysis of these data were: (1) Verbal reinforcement under the operationally framed conditions as specified, did not exert any significant changes, at least at the .05 level of confidence, in pupils classified as being low in adjustment and (2) Verbal reinforcement, under the operationally framed conditions specified, did not exert any significant changes in the work output measured in terms of correct responses, of "maladjusted" pupils in the task of arithmetical computation over the six week period covered by the experiment.

89 pages. \$1.11. Mic 56-443

GUIDING THE IMPROVEMENT OF SELF-UNDERSTANDING OF SIXTH GRADE CHILDREN: A MENTAL HEALTH EXPERIMENT

(Publication No. 15,128)

William Earl Engbretson, Ph.D.
Northwestern University, 1955

Problem. This experimental study was designed to test the hypothesis that the self-understanding of a sixth grade class in a public school could be improved by means of an organized program. The experiment took approximately three months. Five sixth grade classes in the same school acted as controls. The groups were tested before and after the experiment.

Procedures. A two-fold approach was used with the experimental group. First, a series of twenty-four stories were written for class discussion. The discussion pattern follows: (1) the story characters, their behavior, and the causes of their behavior were analyzed, (2) others who behaved in similar ways were discussed, (3) finally, the children's own behavior was discussed. Discussions were approximately forty minutes in length and were held two or three times a week for ten weeks. The second part of the two-fold approach consisted of three individual interviews with each child. These were held before the first group discussion, around the twelfth, and after the last story-discussion. These interviews were not intended to be therapeutic; rather, they were planned to be largely informational, supportive, and evaluative.

Two evaluative procedures were used. First, the groups were tested initially and finally with four measures, the California Test of Personality, essays on "What I Like About Myself" and "What I Dislike About Myself," a modified social distance scale, and a series of three sociograms with friends, play, and work criteria. The results were presented quantitatively in terms of group means which were analyzed for comparative changes. Where appropriate, means were tested for significance of differences with the *t* test. All groups were given an academic achievement test. Results were similarly treated. This constituted the quantitative part of the evaluation. Secondly, qualitative analyses were made of various data from the experimental group alone. These data were compiled from tape recordings of the story-discussions, students' written responses to each discussion, a record of discussion participation, an analysis of students' written problems and wishes, the three individual interviews, interests and activities questionnaires, and final evaluative questionnaires of students, parents, and teacher.

Results. (1) Quantitatively, the experimental group made small but consistent gains on the personal measures of personality and self-likes and dislikes, as compared with the controls. These gains were generally statistically insignificant.

(2) A slightly significant gain was made on the social distance scale, but the other social measure, the sociogram, showed a lack of positive gain.

(3) The achievement data indicated that the experimental group did not suffer academically despite the time devoted to the experiment.

(4) Qualitatively, most of the children in the

experimental group indicated that they understood themselves and others better in their oral and written comments.

(5) The student, parent, and teacher questionnaires indicated increased self-understanding and understanding of others which was reflected in the behavior and attitudes of most of the children.

(6) As measured, the experimental class became interested in more things and engaged in a wider variety of activities.

(7) A few children made little progress and communicated some resistance to further self-understanding.

Recommendations. The conclusions and implications appear to indicate that further research of the following types is needed.

(1) A longitudinal study of self-understanding and its relationships to understanding of others.

(2) Further development, evaluation, and refinement of methods and materials for self-understanding.

(3) The teacher's role in the development of self-understanding.

(4) The relationships between self-understanding, mental hygiene, and human relations.

242 pages. \$3.03. Mic 56-444

**INTRA-FAMILY ASSOCIATIONS AND RELATIONSHIPS
OF MALADJUSTED AND WELL-ADJUSTED
CHILDREN: A DETERMINATION OF THE
STATISTICAL SIGNIFICANCE OF DIFFERENCES
BETWEEN MALADJUSTED CHILDREN AND WELL-
ADJUSTED CHILDREN OF GRADES FOUR TO EIGHT
IN THE EXTENT AND ENJOYMENT OF THEIR
ASSOCIATIONS AND RELATIONSHIPS WITH THEIR
PARENTS AND OTHER MEMBERS OF THEIR
IMMEDIATE FAMILIES**

(Publication No. 15,565)

Horace Bryce Hand, Ph.D.
New York University, 1955

Few problems in life are more important to the individual than that of how best to adapt himself to his circumstances and his fellow-beings. As one approach to understanding the problem, this investigator has studied the relationships between the level of personal adjustment of fourth- to eighth-grade pupils and the experiences which the same pupils share with the various members of their families. These intra-family associations were considered from the two points of view of (1) their extent and (2) their acceptability to the child.

Nearly one-third of the 351 pupils available were selected as well-adjusted, and almost one-third as maladjusted. The instruments of selection were three, viz., the California Test of Personality, ranking by teachers, and sociogram choices by classmates. Good agreement among these instruments was needed for acceptance of any particular child as one of the 27 well-adjusted boys, 27 maladjusted boys, 24 well-adjusted girls, or 24 maladjusted girls.

Through a questionnaire regarding the experiences shared by the pupil with his mother, father, siblings, and

other members of his immediate family, data for the comparison of well-adjusted with maladjusted groups were secured. The written answers were corroborated or, if necessary, corrected in a later conference between child and investigator.

Tabulations and comparisons were made for the number of shared experiences with each type of family-member, liking or dislike of children for the various experiences, intelligence of the children, average number of family-members per child, and number of mothers employed outside the home. In each comparison, the difference of means for the well-adjusted and maladjusted groups was determined, a *t* ratio calculated, and the statistical significance of each such difference of means ascertained. Differences were accepted as significant only if they could have occurred by chance not oftener than one time in twenty.

The well-adjusted children far surpassed the maladjusted children in the extent of most types of shared experience reported for fathers and for mothers, and somewhat surpassed them for sibling associations. The results for other family-members were indefinite. The data of the study indicate unquestionably that well-adjusted children reported a much greater amount of companionship with each of the parents than was reported by maladjusted children. There is also evidence that the well-adjusted children liked such intra-family experiences more than the maladjusted ones did.

The well-adjusted boys (but not the girls) consistently reported much more sharing of affection with their mothers, fathers, and siblings. Both well-adjusted boys and well-adjusted girls acknowledged the by far greater extent of outside-the-home goings and doings, both with mothers and with fathers.

For parents, and for all other persons who have an interest in the mental health of children, the outcomes of this study point to one recommendation. In every possible way, members of each family should do many things together---not alone those that customarily go on at home, but also and especially those which involve the whole family in going together, doing together, and enjoying together. It is particularly essential that each child have such companionships with the parents---both of them.

146 pages. \$1.83. Mic 56-445

**THE EXPRESSED READING INTERESTS OF FIRST-
GRADE BOYS AND GIRLS, AND THE ADEQUACY OF
CURRENT BASIC READERS IN MEETING THESE
INTERESTS**

(Publication No. 15,599)

James Maurice Harris, Ph.D.
Cornell University, 1955

There were two main purposes in this investigation, one of a general nature, the other more specific. The general purpose was to investigate the major interests of first-grade boys and girls, especially as these interests relate to the process of reading. The specific purpose was to determine the relationship of interest in current basic readers to the factors of sex, intelligence level, and reading ability. In connection with these purposes the following questions were chosen for investigation:

1. How do the general interests of boys and girls differ, and how are these differences related to interest in reading?

2. How do the sexes differ in regard to amount of interest in basic reading material?

3. Are pupils of high intelligence more likely or less likely to choose basic reader material in preference to other types of content than are pupils of low intelligence?

4. Are good readers more likely or less likely to choose basic reader content in preference to other kinds of material than are poor readers?

The intelligence level and the reading ability of the children studied were measured by well-known standardized tests. Their general reading interests were investigated by means of individual interviews in which questions were asked regarding the kinds of stories preferred; the kinds of radio and television programs, movies, and comic strips liked best; and similar questions. Their degree of interest in the basic readers was measured by means of the Interest Index, an instrument devised by the writer and consisting of twenty-four pairs of illustrated stories. In each case one of the selections was from the current basic readers; the other was material devised by the writer which he has labeled "adventure and excitement" and "factual information". Only brief sketches of the stories were given. These were read to the students while the illustrations were flashed on a screen. Pupils indicated which of each pair they liked better by encircling either a "1" or a "2" for each pair presented.

The statistical technique of analysis of covariance was used to equate individuals on the factors of sex, intelligence level, and reading ability. In this way it was possible to test the influence of each of these factors on interest in the basic readers while concurrently equating the children on the other two factors.

The general findings of this experiment were as follows:

1. Girls showed greater preference for basic reader material than did boys. When intelligence and reading ability were statistically controlled, the difference in interest between the sexes was significant at the one per cent level of confidence.

2. When the factors of sex and reading ability were controlled, no differences were found in basic reader interest between pupils of high and of low intelligence.

3. Good readers were less inclined to be interested in basic readers than poor readers. When the factors of sex and intelligence were controlled, the difference found was significant at the five per cent level of confidence.

4. Interviews disclosed that both boys and girls enjoyed animal stories, fairy stories, funny stories, and stories about cowboys and Indians. Girls were more inclined to like stories about children and about romance and marriage than were the boys; boys chose adult adventure and other kinds of exciting stories more often than did the girls.

The conclusions drawn from this study are that girls are more inclined to like first-grade reading texts than are boys; poor readers are more inclined to like these materials than are good readers; and that level of intelligence does not appear to be associated with interest, or non-interest, in the basic readers.

197 pages. \$2.46. Mic 56-446

POSSIBLE DETERMINANTS AND OUTCOMES OF THE ORIENTATION PROGRAM AT THE UNIVERSITY OF MINNESOTA

(Publication No. 14,530)

Charles Leonard Lewis, Ph.D.
University of Minnesota, 1955

Adviser: C. Gilbert Wrenn

General orientation programs and orientation courses to facilitate high school-college transition have been developing in American colleges and universities for the past sixty to seventy years. This study is an empirical investigation of students who entered the University of Minnesota through a general two-day orientation-registration program or independent of that program. The general problem is a comparative analysis of two populations (attendance or non-attendance at the Two-Day Orientation-Registration program) in terms of selected characteristics and possible adjustments to the University over a two-year period following initial registration.

The parameter for the study consisted of new, first admission registrants between seventeen and nineteen years old in the General and Science, Literature, and the Arts Colleges for the Fall Quarter, 1952. Identical studies were effected for the two colleges because the student ability levels and personnel services for the two colleges differed.

Two major questions are investigated, 1) Are there differences between oriented and non-oriented students on selected characteristics which might affect whether or not they attend the program? 2) Are there differences between oriented and non-oriented students on selected criteria for collegiate adjustment over a two-year period following initial registration? The characteristics investigated are admission date, residence, economic status, leisure interests, and geographic proximity to the University. The collegiate adjustment areas investigated are academic adjustment, use of personnel services, and activities participation. The questions studied by specific hypotheses about selected variables logically related to the characteristics and adjustments.

Initial homogeneity of the oriented and non-oriented populations was established on selected variables related to collegiate ability and sex. Control of extraneous variation was attempted by carefully defining the universe. Control on criterion fulfillment was attempted by subdividing the populations by opportunity to attend the program and continued registration.

Specific results and conclusions for the two college studies are not consistent. This is not unexpected since they enroll students with different ability and educational objectives. The general conclusions are:

1. The oriented and non-oriented students within each college are homogeneous with respect to collegiate potential as measured by the American College Examination and high school achievement.

2. Oriented and non-oriented students in each college do not differ with respect to the selected population characteristics investigated except that 1) non-oriented students tend to be admitted late in the summer,

- 2) General college non-oriented students more frequently say their father's occupational level is low and that they do not live at home.
3. Although the differences are not always statistically significant nor consistent for the two college studies, these results pertain to the adjustment investigation. (a) Oriented students tend to continue University of Minnesota registration longer than non-oriented students. (b) There are no differences in the use of personnel services by the two populations. (c) Oriented students tend to participate in activities more frequently than non-oriented students.

Among the implications for orientation planning and research are:

1. More attention to orientation programming specifically planned to encourage continued registration is suggested and would likely be successful.
2. A similar follow-up study with random assignment of students to different orientation procedures is needed.
3. A study utilizing the inter-relationships of the variables used in this study with an appropriate predictive design would be useful for orientation evaluation.
4. Students missing regular orientation-registration program probably need special attention early in their collegiate careers. 269 pages. \$3.36. Mic 56-447

THE EFFECT OF LEVEL OF ASPIRATION UPON THE LEARNING OF SKILLS

(Publication No. 15,237)

Rutherford Emanuel Lockette, Ed.D.
University of Illinois, 1955

The investigator purported to survey the effect of level of aspiration upon the learning of skills. It was his thesis that realistic goal-setting promoted efficient learning. Deduced from this central purpose were the following hypotheses:

1. Learners who have realistic levels of aspiration are better satisfied with their performance than learners whose levels of aspiration are unrealistic.
2. Learners who have realistic levels of aspiration are more successful in achieving an ultimate goal than learners whose levels of aspiration are unrealistic.
3. Learners whose levels of aspiration are realistic make more specific judgments with regard to what is needed to improve.
4. Learners who have realistic levels of aspiration show less variability, from trial to trial, in their degree of self-confidence in their ability to learn than do learners whose levels of aspiration are unrealistic.

In order to explore these hypotheses, an experiment was conducted involving a typical shop task, that of planing a piece of wood to pre-set dimensions. Untrained junior and senior high school subjects were selected and randomly divided into groups to perform this task six times according to instructions which were varied to produce differences in level of aspiration. Two of the groups were

treated to set realistic levels of aspiration, and two groups were treated to set unrealistic levels of aspiration. A control group was also employed. The experimental groups in each treatment were varied in two ways--one group wrote statements telling what they were going to do on their next trial and the other group did not.

Statistical analysis of the data was employed to determine whether the hypotheses were supported. Based on this analysis, the investigator ascertained that:

1. Realistic subjects set lower levels of aspiration than unrealistic subjects.
2. Realistic subjects set goals closer to their level of past performance than unrealistic subjects.
3. Realistic subjects performed more closely to their levels of aspiration than did unrealistic subjects.
4. Realistic subjects were better satisfied with their performances than unrealistic subjects.
5. Performance of realistic subjects exceeded the performance of unrealistic subjects. Performance was viewed in terms of two distinct properties describing it:
 - a. actual performance scores.
 - b. proportion of possible improvement which subject made.
6. Evidence, though inconclusive, supports the hypothesis that realistic subjects are more specific in making judgments about what is required for the improvement of their performances than unrealistic subjects.
7. There were no statistically significant differences among the experimental groups with reference to variability of subjects in their degree of confidence in their ability to learn.

On the basis of these findings, the following conclusions seem warranted:

1. Subjects who received realistic treatment were superior to subjects who received unrealistic treatment, based on group means and/or variances.
2. The method of teaching which effects realistic goal-setting by students is superior to a method which effects unrealistic goal-setting in inspiring satisfaction in learners.
3. Learners who approach a task realistically are better able to specify their improvement needs than learners unrealistically task-oriented.
4. The measures relative to confidence in ability to achieve the level of aspiration were insufficient to test this hypothesis adequately.
5. Goal-setting, either realistic or unrealistic, is superior to no goal-setting at all.
6. Having subjects indicate what they are going to do to improve influences realistic subjects to improve to a greater extent than other subjects treated similarly but who made no statements.

These findings support the general hypothesis that realistic and unrealistic levels of aspiration are goal determinants in the learning of skills. Realistic levels of aspiration had greater efficacy for learning skills than unrealistic levels of aspiration.

88 pages. \$1.10. Mic 56-448

AN ANALYSIS OF CERTAIN CHARACTERISTICS OF ABOVE-AVERAGE AND BELOW-AVERAGE MALE AND FEMALE READERS AT THE NINTH-GRADE LEVEL

(Publication No. 15,605)

Walter Joseph Pauk, Ph.D.
Cornell University, 1955

The purpose of this study was to investigate traits and abilities which were found to differentiate ninth-grade students who were above- and below-average in reading abilities. This study was further designed to assess any sex differences which might exist in the test profiles of above- and below-average readers.

The investigator divided the 300 subjects according to sex. This division resulted in an equal distribution of 150 girls and 150 boys. Each group was further divided into two categories representing (1) above-average boy readers, (2) below-average boy readers, (3) above-average girl readers, and (4) below-average girl readers.

The analysis of the data was divided into three phases. The first phase was the computation of the discriminant function, and the computation of F-values to provide a basis for evaluating the effectiveness of the battery for differentiating between above- and below-average readers. The second phase dealt with determining which tests, if any, could be eliminated from the battery without significant loss in the effectiveness of the battery for differentiating between the groups of above- and below-average readers. The third phase dealt with determining the relative contribution which was made by each test to the test battery as a whole. The relative contribution was interpreted as percentage of contribution.

Girls: The results were that all eight variables used in the discriminant function, when subjected to a test of significance, proved to be significant beyond the one per cent level of probability as differentiating between above- and below-average girl readers.

Girls: The relative contribution (percentage) of each variable to this battery of tests follows: Mechanical Reasoning (DAT) 1.63, Reflective (Thurstone) 3.72, Survey of Study Habits and Attitudes (Brown-Holtzman) 3.72, Numerical Ability (DAT) 5.07, Abstract Reasoning (DAT) 6.00, Spelling (DAT) 17.01, Sentences (DAT) 17.65, and L-Score (ACE) 45.20.

Girls: By eliminating variables, systematically, from the discriminant function, results revealed that there was no significant loss in differentiating efficiency of the battery by the elimination of Abstract Reasoning, Numerical Ability, Survey of Study Habits and Attitudes, Reflective, and Mechanical Reasoning.

Boys: The results were that all eight variables used in the discriminant function, when subjected to a test of significance, proved to be significant beyond the one per cent level of probability as differentiating between above- and below-average boy readers.

Boys: The relative contribution (percentage) of each variable to this battery of tests follows: Sentences (DAT) 1.65, Reflective (Thurstone) 2.25, Spelling (DAT) 6.52, Space Relations (DAT) 6.59, Survey of Study Habits and Attitudes (Brown-Holtzman) 7.03, Abstract Reasoning (DAT) 16.78, L-Score (ACE) 24.94, and Numerical Ability (DAT) 34.51.

Boys: By the systematic elimination of variables from the discriminant function it was found that a significant

loss was caused in the differentiating efficiency of the test battery by the elimination of any one variable. The null hypothesis was rejected by an F-value which was significant beyond the one per cent level.

It appears that the girls, in this study, who were above-average in reading skills were differentiated by their linguistic abilities as measured in terms of scores on the following tests: L-Score (ACE), Sentences (DAT), and Spelling (DAT). On the other hand, the boys in this study who were above-average in reading skills were differentiated by their abilities, skills, and attitudes as measured in terms of scores on the following tests: Numerical Ability (DAT), L-Score (ACE), Abstract Reasoning (DAT), Survey of Study Habits and Attitudes (Brown-Holtzman), Space Relations (DAT), Spelling (DAT), Reflective (Thurstone), and Sentences (DAT).

161 pages. \$2.01. Mic 56-449

A COMPARISON BETWEEN 9TH AND 12TH GRADE STUDENTS ON SELF-ESTIMATES OF ABILITIES AND OBJECTIVE SCORES ON THE DIFFERENTIAL APTITUDE TESTS

(Publication No. 15,552)

Jacob Schulman, Ed.D.
New York University, 1955

Chairman: Professor Milton Schwebel

The purpose of this study was to investigate the differences between 9th grade and 12th grade students when their estimates of their abilities were compared with their scores on objective tests.

The studies of Ginzberg and Small and the theoretical formulation of Super were reviewed and were found to point up the need for further research into the dynamics of vocational development.

A review of the related literature on self-appraisal indicated that studies deal in the main with the accuracy of self-estimates among college freshmen. The present investigation deals with self-understanding among students at the secondary school level. It was hypothesized that the learning experienced by students during their three-year period of high school education contributed to a more realistic appraisal of their abilities. Evidence for the support or rejection of this hypothesis was obtained by studying a matched sample of 106 9th grade students and 106 12th grade students at Mineola High School, Mineola, New York. The matching variables were sex, intelligence, and father's occupation.

A self-rating form was constructed which provided for a student's estimate of his abilities as LOW, LOW AVERAGE, HIGH AVERAGE, or HIGH as measured by the following tests of the Differential Aptitude Tests: VERBAL REASONING, NUMERICAL ABILITY, ABSTRACT REASONING, SPACE RELATIONS, MECHANICAL REASONING, CLERICAL SPEED AND ACCURACY, SPELLING, and SENTENCES.

Group discussions led by two experienced school counselors preceded the filling out of the self-rating form to provide greater understanding on the student's part of the required task.

The reliability of the self-rating form was ascertained by having a sample of 9th and 12th grade students repeat the performance within a week after the forms were originally filled out. Correlations between first and second ratings were sufficiently high (.901 and .878) to warrant the statement that the form was a consistent measure of the student's estimates of his abilities.

The Differential Aptitude Tests, measuring the student's abilities in the eight areas listed above, were administered to the subjects in the study.

The experimental data consisted of estimated ratings and obtained ratings on each of the eight tests of the Differential Aptitude Tests for 106 students in the 9th and 12th grades, respectively. Eight difference scores were obtained for each of the students in the study.

Two approaches — an analysis of variance design and a comparison of correlations study — were employed to determine whether significant differences existed between the 9th and 12th grade students.

The data were also examined for implications for curriculum planning and student personnel services in the high school, and for contributions of the findings toward a theory of vocational development.

The findings lead to the following main conclusions:

1. High school seniors have a more realistic understanding than high school freshmen of their relative position in their own grade on the abilities measured by the Differential Aptitude Tests.
2. The more closely a test of the Differential Aptitude Tests battery approximates the content of an area of instruction in the high school curriculum, the higher the degree of self-understanding achieved by both 9th and 12th grade students with respect to the ability measured by that test.
3. As students progress from the 9th to the 12th grade, continuous and well-defined instruction in specific areas of the high school curriculum results in greater self-understanding among high school seniors in these areas.

It was suggested that the progressive development of a sense of reality on the part of high school students calls for an educational program which will provide experiences to which students can relate and apply in meaningful ways the knowledge and skills that they acquire in their high school courses.

84 pages. \$1.05. Mic 56-450

THE RELATION BETWEEN SOCIO-ECONOMIC STATUS AND INTELLIGENCE OF EGYPTIAN PUPILS IN ALEXANDRIA

(Publication No. 15,415)

Ali Fahim Mohamed Shaltout, Ed.D.
Wayne University, 1955

The fact that there are, on the average, substantial differences in I. Q.'s between pupils from "high" or "good" or "favorable" socio-economic or social-class backgrounds and pupils from "low" or "poor" or "unfavorable" backgrounds has been well established by many investigations

in different countries. The present study was undertaken to see whether the same situation exists among Egyptian pupils.

The writer tried to answer the following questions:

- (1) Is there any relation between socio-economic status and intelligence among Egyptian pupils in Alexandria?
- (2) If there is a relation, what is its amount compared with the findings in America, Europe, and other countries?
- (3) What are the different interpretations of these findings?
- (4) How do these interpretations affect modern educational theory and practice?

A sample of 1563 pupils in Alexandria, Egypt, at the age range of eleven to sixteen, and in the fourth grade of primary schools, was given a group intelligence test (Ballard Test modified). The socio-economic or social-status background of the pupils was measured by means of a questionnaire devised by the writer and filled in by the pupils. By means of this questionnaire information was gathered about the income of the family, educational level of the father, occupational field of the father, and occupational position of the father. The relationship of these four social status factors to I. Q.'s was analyzed by correlation procedures involving the total group of pupils, by comparing the means for the two extreme occupational levels, and by percentages of dull, normal and bright pupils as far as the four social factors of fathers' income, education, occupational field and occupational position were concerned.

Summary and major findings:

- (1) There is a definite relationship between three factors of socio-economic status (income, education, and occupational level of father) and I. Q.'s. The coefficient of correlation (r) between income of families and I. Q.'s of children is .21. The coefficient of contingency (c) between occupations of fathers and I. Q.'s of children is .24. The differences between the means of the extreme occupations is 23 points (professions $M = 115$ - unskilled workers $M = 92$). The coefficient of correlation (r) between educational level of fathers and I. Q.'s of their children is .27.

- (2) The amount of relationship found between socio-economic factors and I. Q.'s among Egyptian pupils in Alexandria is nearly the same as in America, Europe, and other areas.

- (3) The writer cannot directly conclude anything about the reasons or causes of the relationship between socio-economic status and intelligence.

- (4) The interpretations of differences by genetic ability, developmental factors, and cultural bias in test items are discussed along with their relations to educational theory and practice.

156 pages. \$1.95. Mic 56-451

DEVELOPMENT AND STANDARDIZATION OF A TEST OF PSYCHOLINGUISTIC GROWTH IN PRESCHOOL CHILDREN

(Publication No. 15,271)

Dorothy Jean Sievers, Ph.D.
University of Illinois, 1955

The purpose of the present study was to (1) devise a series of tests which measure the various aspects of language in preschool children according to a theory of

communication as postulated by Professor C.E. Osgood, and (2) obtain normative data on the scale with a sample of average children between the ages of two and six.

According to the theory, there are three processes involved in language: (1) decoding, (2) association, and (3) encoding. This behavior also has three levels of organization: (1) semantic, (2) grammatical, and (3) integrational. Two channels of transmission are included: (1) perceptuomotor and (2) auditory-vocal. From these, 18 facilities of language were hypothesized. Because these behaviors could not be manifested in isolation in a test situation, it was impossible to construct "pure" tests of the preceding facilities. Consequently 11 tests, each of which involved several facilities, were selected. They were (1) Labeling, (2) Mutilated Pictures, (3) Object Association, (4) Word Association, (5) Form Tracing, (6) Gesture Sequence, (7) Speech Sound Mimicry, (8) Nonsense Grammatical Mimicry, (9) Gestural Conversation, (10) Picture Series, and (11) Vocal Cloze. The test battery was called the Differential Language Facility Test.

The test was given to 228 boys and girls between the ages of two and six with Stanford-Binet IQ's from 89 to 123. Information on the occupations of the fathers was also obtained. The following results were found:

1. There were no significant differences between boys and girls in language development as measured by the Differential Language Facility Test.

2. The level of performance increased linearly with age in terms of the total scores. The scores on Labeling, Mutilated Pictures, Nonsense Grammatical Mimicry, Form Tracing, Picture Series, and Vocal Cloze also showed linear trends with age. The scores on the other subtests did not demonstrate this linearity at all age levels. Improvement in performance on Word Association showed larger increments at the earlier age levels. However the size of these increments became quite small by the age of four indicating negative acceleration in the development of the behavior within this test. The Speech Sound Mimicry subtest needed more difficult items for the older age groups.

3. With the exception of the three labeling tests which intercorrelated highly, the relatively low intercorrelations among the other subtests suggested that they were measuring independent functions.

4. The intercorrelations among the subtests also indicated certain relationships with the 18 language facilities postulated to be involved in the tests. The commonality of speech facilities appeared to be a more important determinant than the commonality of perceptual facilities in the intercorrelations of the subtests. The presence of perceptual semantic decoding and encoding or speech semantic decoding and encoding was the most prominent factor in determining the level of performance on the Differential Language Facility Test.

In conclusion, it is believed that sufficient information was obtained from this study to warrant the use of the test in investigations of children with language difficulties.

148 pages. \$1.85. Mic 56-452

DISTINCTIVE PERSONAL PROBLEMS OF HOME ECONOMICS STUDENTS AT THE UNIVERSITY OF ILLINOIS

(Publication No. 15,272)

Elizabeth Jane Simpson, Ed.D.
University of Illinois, 1955

The purposes of this study were to ascertain the distinctive personal problems of home economics students at the University of Illinois, to determine whether there were significant differences in problems among the home economics students in the four classes and between married and single home economics students, and to explore the possibilities that problems of home economics students differed according to (1) place of residence, (2) religious preference, and (3) occupational status of parents. The major hypothesis was that students of home economics at the University of Illinois have personal problems that are different from those of women students in other curricular areas.

The Mooney Problem Check List, College Form, and an original supplement, prepared by the investigator, were used in collecting data concerning the personal problems of 600 women students at the University. Of this number, 60 were in the arts curriculum, 50 in commerce, 109 in education, 190 in home economics, 47 in journalism, 70 in liberal arts and sciences, and 74 in physical education.

On both the check list and the supplement students were asked to underline the items which suggested troubles of concern to them and to circle the numbers in front of items of most concern. They were also asked to give information concerning their curriculum, class in college, marital status, place of residence, religious preference, and parents' occupations.

The chi-square technique was used in order to test for differences among groups in the marking of individual items. Analysis of variance was used in order to determine whether there were significant differences among weighted problem counts for the eleven problem areas of the Mooney Problem Check List. Where significant *F*'s were found, the *t* test was used in order to discover where the differences were located.

Comparisons were made between home economics students and students in other curricular areas in the marking of the check lists. Students in home economics expressed greater concern with the problems in the area of adjustment to college work than did the students in at least two other areas. The problems of the home economics students centered around study skills and verbal abilities. In general, the home economics students expressed less concern in the areas of personal-psychological relations, the future: vocational and educational, morals and religion, finances, living conditions, and employment, and home and family.

Problems in the supplement most frequently marked by the home economics students were those concerned with adjustment to college work and time management. Chemistry and rhetoric were the subject matter courses considered most difficult.

Sophomores expressed more concern than did juniors and seniors in the problem areas of health and physical development, finances, living conditions and employment, personal-psychological relations, courtship, sex, and marriage, and adjustment to college work. Freshmen expressed more concern than seniors only in the area, adjustment to college work.

Married home economics students marked fewer problems than did single students and indicated less concern about some of the items concerned with time management. Rural students indicated that they were more concerned about some of the problems of adjusting to college life than were the urban students. There were some evidences that Roman Catholic students were somewhat more problem-conscious than Jewish and Protestant students, particularly in the area of home and family. Also, there were some evidences that the home economics students whose parents were laborers had more problems in the area of finances, living conditions, and employment than had the daughters of parents in other occupational categories.

A next step in research might be to ascertain whether the home economics students at the University of Illinois really do have as many problems as they apparently think they have in the area of adjustment to college work. If the problem is as severe as it appears to be, improvements in curriculum and guidance might be made in order to help alleviate the difficulties. 216 pages. \$2.70. Mic 56-453

EDUCATION, TEACHER TRAINING

A FOLLOW-UP INQUIRY OF SECONDARY SCHOOL MUSIC TEACHERS PREPARED AT SAN JOSE STATE COLLEGE

(Publication No. 15,341)

Forrest John Baird, Ed.D.
Stanford University, 1955

Purpose: To determine how well the curriculum at San Jose State College for the training of applicants for the Special Secondary Credential in Music meets the needs of graduates when they are placed in teaching.

Music graduates from San Jose State College for the period 1949-1953 and administrators who employed them rated, on a five point scale, the importance of listed general education and professional teaching competences and the effectiveness of the curriculum in developing them. Graduates and San Jose State College music faculty judged music teaching competence importance and curriculum effectiveness in developing music teaching competences listed. Responses were:

| | Questionnaires | | Per Cent |
|----------------|----------------|----------|----------|
| | Distributed | Returned | |
| Graduates | 73 | 61 | 83.6 |
| Administrators | 49 | 29 | 59.2 |
| Music Faculty | 20 | 19 | 95.0 |
| | 142 | 109 | 76.6 |

Numerical values were assigned to each of the five categories of importance and effectiveness and mean-score calculated.

General Education mean-scores were:

| | Graduates | Administrators |
|--------------------------|-----------|----------------|
| Competence importance | 4.1 | 4.2 |
| Curriculum effectiveness | 3.4 | 3.7 |

Differences between importance and effectiveness for both graduates and administrators were significant at the 1 per cent level.

Professional Teaching results were:

| | Graduates | Administrators |
|--------------------------|-----------|----------------|
| Competence importance | 4.1 | 4.2 |
| Curriculum effectiveness | 3.4 | 3.7 |

Differences between importance and effectiveness for both graduates and administrators were significant at the 1 per cent level.

Music Teaching results were:

| | Graduates | Music faculty |
|--------------------------|-----------|---------------|
| Competence importance | 3.8 | 3.9 |
| Curriculum effectiveness | 3.2 | 3.0 |

Differences between importance and effectiveness for both graduates and music faculty were significant at the 5 per cent level.

Composite rank order of music teaching competence importance as judged by graduates and music faculty at San Jose State College indicates that a music teacher should: Select materials appropriate to the performing group. Conduct musical organizations. Tune and adjust any band or orchestra instrument. Select and establish tempo for musical performance. Train and conduct vocal or instrumental groups. Conduct from a four-part score. Build program to fit the occasion. Adapt music to a performing group. Be acquainted with sources of music. Demonstrate fingering of any standard instrument. Appreciate music literature. Play the major scale of the instrument on one representative instrument from every section of the orchestra. Understand vocal range and quality. Have outstanding ability as an ensemble performer. Adapt program materials to varying conditions. Interpret music through recognition of mood. Be acquainted with contemporary interpreters of music. Arrange vocal and instrumental music. Train and conduct changed or unchanged voices. Detect and correct weaknesses in musical performances. Read any part of a four-part hymn at sight. Interpret music of various periods and styles. Have a knowledge of symphonic literature. Play at sight simple piano music. Have a knowledge of choral literature. Recognize standard musical forms. Have outstanding ability as a soloist. Have a knowledge of solo literature. Analyze standard musical forms. Write melodic dictation.

Understand the physical nature of sound. Improvise simple piano accompaniments. Be acquainted with arts other than music. Be acquainted with the lives of composers. Have a knowledge of chamber literature.

Conclusions:

1. Competences used in this study are required of music teachers.
2. Even those competences standing lowest in the composite rank-order are of moderate (three on a five point scale) importance.
3. All groups participating in the study are agreed on an average of the considerable (four on a five point scale) importance of the competences listed.
4. Curriculum effectiveness at San Jose State College is average in developing needed competences in all three areas.
5. On an average, all groups participating in the study rate competence importance higher than they do curriculum effectiveness.
6. All groups participating in this study agreed that all three areas of competence should receive increased emphasis.
7. Music teaching competences ranked of extreme importance (top of the scale) are predominantly concerned with public performance.
8. Both graduates and music faculty indicate a need for increased emphasis on performance skills.
9. The music faculty were more critical of curriculum effectiveness than were graduates.

195 pages. \$2.44. Mic 56-454

A HANDBOOK FOR THE BEGINNING BUSINESS TEACHER

(Publication No. 13,645)

Mary Brower Canfield, Ed.D.
New York University, 1955

This document is divided into two parts: (1) The Investigation; and (2) The Handbook.

The investigation consisted of: (1) Determining the problems that are likely to confront the beginning business teacher; (2) Preparing a check list of the problem areas that resulted from step one; (3) Submitting the check lists to 50 selected beginning business teachers; and (4) Determining the topics to be dealt with in the Handbook from the findings of the returned check lists. (A 98 per cent return)

The Handbook is comprised of the following six chapters: (1) Vocational Guidance in Business Education; (2) Typewriting; (3) Shorthand and Transcription; (4) Office Practice; (5) Basic Business; and (6) Bookkeeping.

The chapter on Vocational Guidance includes a discussion of six topics: (a) cumulative records, (b) occupational information, (c) selecting students for vocational business training, (d) counseling students, (e) placement, and (f) follow-up.

Classroom organization and management, instructional materials and teaching aids, teaching procedures and techniques, and testing and grading procedures are the topics dealt with in the chapters on Typewriting, Shorthand and Transcription, Bookkeeping, and the latter part of Basic Business (general business). In addition, equipment is discussed in the chapters on Typewriting and Bookkeeping.

The first part of the chapter on Basic Business includes a description of all the basic business subjects taught at the secondary level as well as the outcomes to be achieved in basic business education. The last half of this chapter is concerned solely with the teaching of general business (9th or 10th grade level).

The chapter on Office Practice includes: (a) suggestions for setting up instructional units in the course (content); (b) teaching procedures, aids, and techniques; (c) classification and makes of office machines; and (d) methods of teaching machines work.

Each chapter is followed by an annotated list of resource materials that are available for the particular subject under consideration. For example, the resource materials for the chapter on Typewriting includes textbooks, kinds of equipment and where they may be obtained, a list of typewriting films, and a list of miscellaneous aids available, many of which are free to teachers.

In collecting the material for each chapter, one or more of these sources were used: (1) The published material in the field of business education such as yearbooks, periodicals, textbooks, reference books, government publications, and special surveys; (2) Correspondence with publishers of business education materials and manufacturers of equipment; (3) Interviews with business teachers and businessmen; and (4) The knowledge of the writer that has resulted from extensive training in business education as well as from many years' experience in training business teachers and in counseling with them during their initial periods of teaching.

404 pages. \$5.05. Mic 56-455

A STUDY ASSOCIATED WITH THE RECRUITING OF ELEMENTARY SCHOOL TEACHERS BY THE STATE OF NEW JERSEY

(Publication No. 15,542)

Helen Rumsey Doelee, Ed.D.
New York University, 1955

The Problem

The purpose of this study was to survey programs in the state of New Jersey designed to recruit elementary school teachers.

Need for the Study

Recognition of the serious shortage of elementary teachers in New Jersey and the prospect that such a shortage will continue and become even more grievous indicated the need for this study.

Procedure

Questionnaires, interviews and study of available research materials were used to obtain the information.

Findings and Implications

The New Jersey State teachers colleges even with the help of recruiting programs and the assumption that all who graduate will enter elementary teaching can supply only forty six (46) per cent of the estimated yearly need for elementary teachers in New Jersey.

Continuous evaluation of curriculum is urged in both liberal arts colleges and the State teachers colleges in order to attract young people to the profession and to graduate capable and secure teachers for the elementary grades.

A greater number of scholarships, both from state and lay groups to encourage further training for those who could otherwise not afford college and to further positive attitudes toward the teaching profession, should serve as additional stimuli.

The college catalogue is an important instrument for recruitment. Therefore, it should be attractive with information that is clearly stated and geared to high school students.

Many students involved in this study made decisions about their careers before the twelfth grade. Despite the difficulties and uncertainties involved in attempting to analyze motivations, many of these young people chose teaching because of wholesome experiences with and genuine fondness for children. Future Teachers of America Clubs can play positive roles in planning wholesome activities with children for members.

Visits to colleges that train elementary teachers help students in deciding about a career. These visits should be continuously evaluated by college personnel, guidance personnel and students.

There are few transfers from junior colleges in New Jersey to the State teachers colleges. Reasons for this should be discovered and techniques be refined for the screening of transfer candidates.

Teachers' salaries are considered an important aspect of the current teacher shortage by the New Jersey superintendents. The salary question is linked with certification, working conditions and status of the teacher in the community.

Our boys and girls are America's most important resources. How these resources will be developed depends to a large degree on what we are willing to spend in time, money and energy on public education. Superintendents, principals, teachers, guidance personnel, college professors, students, and parents must be concerned about getting and keeping the best possible teachers. Concern must motivate purposeful and sustained effort on the part of all concerned.

184 pages. \$2.30. Mic 56-456
247 # 3.09

WORKSHOPS ON ECONOMIC EDUCATION SPONSORED BY THE JOINT COUNCIL ON ECONOMIC EDUCATION

(Publication No. 15,548)

Eunice Irene Johns, Ed.D.
New York University, 1955

During the last three decades there have been frequent expressions of concern over the neglect of education for economic understanding in the programs of the public schools. This concern has been in part the result of increased efforts to determine the content of education for effective citizenship in a free society.

The aim of this study became that of examining one phase of the work of the Joint Council on Economic Education, a non-profit organization which was brought into being in order to bring about increased attention to the economic aspects of American society in the public schools. The total program of work undertaken by the Joint Council was examined in order to establish the background for the study. Major emphasis in the program of the Joint Council has been placed on the sponsoring of workshops on economic education, and it is toward this aspect of the program that this study has been directed. It therefore became the purpose of the study to 1) identify the announced purposes of workshops on economic education, and 2) examine the programs and achievements of workshops in an effort to discover the extent to which the purposes have been implemented.

Chapters Three and Four examined in detail the methods by which workshops have been established, where they have been held, and the nature of the programs provided. The examination of the extent to which workshop purposes have been implemented was made by setting up a set of five questions and answering them with respect to each purpose. The answers to these questions revealed outcomes as set forth in Chapter Five. These outcomes, depicting certain positive achievements and some limitations or weaknesses of workshops on economic education, suggest some recommendations which might help to strengthen the programs of workshops.

The six purposes which formed the basis of the analysis were examined separately in Chapter Five in order to discover the extent to which each has been implemented in actual practice in workshops. Yet it is not possible to assign a plus or minus sign to each of the six purposes according to the extent of its realization. The outcomes of the workshops cannot be expressed in mathematical terms since the whole is greater than the sum of the component parts. Taken jointly, the appraisals of workshop resources and methods, of individual attainments and of group progress constitute a general appraisal of the workshops.

The attainment of the purposes of workshops cannot be considered in isolation because together they form an organic whole. Taken together these purposes, although spelled out indirectly, are basically the program of general education. In the final analysis the quality of the workshop program cannot be determined in the narrow sense. It cannot, for example, be judged alone in terms of the economic concepts conveyed to participants, but rather in terms of a larger experience which encompasses the entire field of general education in which economics is one small part.

The study concludes with a list of the achievements of workshops on economic education, and with recommendations which suggest ways in which they may be improved.

318 pages. \$3.98. Mic 56-457

THE NATURE OF THE SUPERVISION OF STUDENT TEACHING

(Publication No. 15,519)

Merton Joseph Merring, Ph.D.
Cornell University, 1955

The intent of this study is to investigate the nature of the supervision of student teaching in 31 universities and colleges during the year 1954. The investigation attempts to accomplish the following purposes:

1. To make a survey of current supervisory practices
2. To evaluate present practice in terms of principles established by current documentation.
3. To make such recommendations relative to the supervision of student teaching done in public schools as may be warranted from an interpretation of the data.
4. To provide data that may be useful in reorganizing teacher education programs to meet the needs of the immediate future.

This study is of the survey type and is nation-wide in scope. Three different types of questionnaires were used. One was designed for student teachers, one for university supervisors, and one for public school supervisors.

The questionnaire concerning student teachers was designed to yield the following types of detail - 1) certain aspects of student teacher activities, 2) student teacher attitudes toward certain supervisory practices, and 3) Student teacher suggestions for improvement of student teaching programs.

The questionnaires for the university and public school supervisors called for information that related to 1) their professional status, 2) supervisory activities, and 3) opinions concerning certain phases of the supervisory technique.

Cooperation was solicited from forty-two universities. Thirty-one institutions actually participated.

The information received was interpreted in the light of eight postulated principles. In establishing authority for the principles two guides were used. First, an effort was made to restrict the use of documentary evidence to that which is substantiated by research methods of recognized standing, or to statements made by authorities whose experience and professional standing leave little question as to the validity of their pronouncements. The second guide was to seek collaborating statements. Principles which are unanimously, or almost unanimously approved by authorities in the field, tend to be fundamentally sound.

This study showed that:

1. The professional status of education rose from meager beginnings in universities around 1890 to a foremost position in 1954. In the latter year degree-granting institutions conferred more degrees at the bachelor's, master's, and doctor's levels to education students than to any other group. Student teaching is generally accepted today.
2. There is much evidence of outstanding student teacher programs and examples of highly commendable public school supervisors.

3. There is wide fluctuation in the organization and conduct of the supervision of student teaching.
4. There appears to be an excessive amount of poor supervision by both university and public school supervisors.
5. Education courses are too numerous and often overlapping.
6. In contrast, an extension of the opportunities for full responsible teaching was requested by the participants.
7. Experiments on a limited scale are being made in the use of tape recorders and motion pictures.

The recommendations are the need for critically analyzing teacher training curricula, reviewing standards by state certification, providing in-service training for student teacher supervisors, extending student teaching, raising the prestige of student teaching, closer observing by supervisors, and improving student teaching through cooperative efforts. 243 pages. \$3.04. Mic 56-458

PHYSICAL EDUCATION EXPERIENCES FOR CLASS- ROOM TEACHERS: AN IDENTIFICATION AND DESCRIPTION OF PRE-SERVICE EXPERIENCES THAT MAY HELP ELEMENTARY SCHOOL TEACHERS TEACH CHILDREN IN THE AREA OF PHYSICAL EDUCATION

(Publication No. 15,551)

Eleanor Jane Patterson, Ed.D.
New York University, 1955

Physical education should be a part of the elementary school curriculum if that curriculum is to meet the needs of children. In many cases it is the classroom teacher who teaches children in this area. Therefore, it is necessary to include physical education in the professional preparation of classroom teachers if they are to provide optimal educational opportunities for children.

The purpose of this study is to identify and describe pre-service experiences that may help elementary school classroom teachers provide physical education for the children enrolled in their classrooms.

There have been three studies in the last fifteen years concerned with training classroom teachers in the area of physical education. These studies have been designed for particular states. Two national studies were done in 1930. This study is national in scope.

The needs of children, about the ages of six through eleven, were documented. Because there is such a vast amount of material dealing with children's needs the investigator used eight representative sources that consider children's needs as they apply to children in elementary school. Twenty-one needs were consolidated into eleven statements.

To establish physical education experiences that may help meet the needs of children the investigator documented scientific literature dealing with elementary school physical education and child growth and development.

Elementary school children's physical education experiences that may help meet their needs are listed on a table showing needs and experiences for primary, intermediate and elementary grade children.

An opinionnaire was constructed, using the results of the first two sub-problems, and submitted to elementary school classroom teachers throughout the country. The opinionnaire asked teachers to check the experiences that should be offered. Names of elementary classroom teachers were obtained from state departments of education and from state colleges and universities. Two teachers from each grade for each of ten geographical areas were sent opinionnaires. Eighty-one of a possible 120 replied.

Opinionnaires were then sent to colleges and schools of education asking them to check whether the experiences can be offered. Ninety-six opinionnaires were submitted and fifty-four replies were received. Critical ratio and chi square techniques were used to determine agreement.

Pre-service experiences that should and can be offered in rank order are as follows:

1. Taking a college class in childgrowth and development.

Planning and organizing physical education activities.

Relating physical education activities to children's needs, interests and abilities.

2. Taking a college class in educational psychology and/or child psychology.

3. Evaluating results.

Observing boys and girls together for physical education activities.

4. Recognizing when children need activity and when they need rest.

5. Recognizing the time and place for competition at the elementary school level.

6. Planning with children.

7. Participating in children's games.

8. Supervised student teaching of children in physical education activities as a part of the total student teaching requirement.

9. Observing the types of physical education activities children like best.

10. Improving motor skills through physical education activities.

11. Recognizing the need for various kinds of control.

12. Assuming leadership roles.

13. Participating in children's rhythms.

14. Participating in planned observations of children in physical education activities.

15. Participating with classmates and/or friends in physical education activities.

16. Taking a college class in safety and first aid.

17. Taking a college class in personal hygiene.

18. Participating with children in physical education activities.

19. Observing boys and girls separated for physical education activities.
20. Participating in professional laboratory experiences after student teaching.
21. Participating in children's self-testing activities.
22. Participating in children's relays.
23. Participating in swimming activities.

These experiences are of value as they relate to children's needs and physical education experiences that may help meet children's needs. It is the hope of the investigator that these experiences may be included in college curricula. 247 pages. \$3.09. Mic 56-459

THE ORGANIZATION OF THE IN-SERVICE EDUCATION PROGRAM FOR ELEMENTARY TEACHERS IN MOREHOUSE PARISH, LOUISIANA

(Publication No. 15,472)

James McCoy Pridgeon, Ed.D.

George Peabody College for Teachers, 1955

Major Professor: Harold D. Drummond

This study is concerned with the organization of in-service education of teachers with special reference to Morehouse Parish, Louisiana. Specific aspects of the problem include: (1) identification of organizational practices as promising; (2) identification of elementary school teachers' problems in Morehouse Parish; and (3) suggestions for improving the organization of the parish in-service program.

After a survey of literature, opinions of forty-seven educators were used in selecting fifteen school systems with outstanding in-service education programs. Officials in these school systems identified practices which they believed were outstanding in the organization of their in-service programs. Officials were interviewed in five school systems in Southern states and personal letters were used to secure data from ten officials in other parts of the United States. The organizational practices reported were analyzed, practices were identified as promising and were compared with practices in Morehouse Parish, Louisiana.

A free-response interview schedule was developed and used during interviews with sixty school staff members in Morehouse Parish.

The significant findings revealed in this study were as follows:

1. Practices were identified as promising in the organization of in-service education programs in these areas: Administrative policies and procedures. Financial policies. Leadership responsibility. Planning for in-service growth. Techniques and resources. Community relations and support. Induction of new teachers. Methods of communication. Providing time for activities.

2. Listed below are some of the problems identified for elementary school teachers: Grouping, motivation of pupils. Overcrowded conditions. Insufficient time for professional growth. Pupil progress and promotions. Staff relations. Planning curriculum content. Home-school

relations. Orientation, assistance for new teachers. Too many meetings. Record keeping. Opportunity for professional growth. Opportunity to share in formulating policies.

3. In some aspects the in-service activities in Morehouse Parish, Louisiana, were found to compare favorably with those surveyed in other states. Some recommended practices, however, had not been followed. For example: (1) in-service education as an integral part of the total school program; (2) a program available to all teachers; and (3) a program with definite aims and objectives.

The recommendations listed below were among those made for Morehouse Parish, Louisiana:

1. The board of education should require the organization of an in-service program, an administrative council, and two in-service planning committees—one for white and one for Negro teachers.

2. Funds should be increased to provide a professional library, ten in-service days for teachers, an expense account to send staff members to professional meetings, and additional consultant services.

3. The administration should assume direct responsibility for coordinating the program.

4. General policies and plans for in-service education should be the major responsibility of an in-service planning committee.

5. Plans should be based on the needs of the school system and the problems and interests of teachers.

6. The child study program should be continued and opportunities to study curriculum development should be provided.

7. Each school faculty should be encouraged to engage in some type of study as a group.

8. Public relations activities should be included as a means of securing community support for in-service education.

9. Orientation meetings, handbooks, and other printed matter relative to the schools should be provided for new teachers before school starts.

10. Experienced teachers, released from regular duties, should act as "teacher aids" in assisting new teachers during the year.

11. Techniques should be developed to provide better communications to and from the staff.

12. Substitute teachers should be employed to release teachers responsible for special in-service activities.

384 pages. \$4.80. Mic 56-460

CASE STUDIES OF NURSERY SCHOOL CHILDREN— A MANUAL FOR STUDENTS IN TEACHER TRAINING

(Publication No. 15,553)

Rebekah Margaret Shuey, Ed.D.
New York University, 1955

The purpose of this project was to compile case studies of nursery school children for use in a manual for students in teacher training. The manual was designed as a teaching instrument to aid students in understanding the behavior of young children and in clarifying their own roles as teachers.

There were two main problems in working out the project: the development of the manual and its use with students.

The steps in developing the manual were (1) formulation of a case study outline containing categories important for teacher understanding, (2) selection of children on whom cases would be compiled, (3) collection of data for the studies, and (4) organization of data according to the case study outline.

This outline was built on three criteria: presentation of "the whole child," emphasis on factors important to mental health, and inclusion of cultural background. The categories in the outline depicted goals of nursery education, namely, to help each child learn and grow toward maturity. The outline used is as follows:

A. Description of Child and Cultural Background

B. School Records and Parent Contacts

C. Analysis of Records by Categories

1. Relationships with Children

2. Relationships with Adults

3. Intellectual Capacities, Modes of Learning and Skills

4. Handling of Emotions

5. Acceptance of Self

6. Regulation of Primary Life Functions

D. Summary of Analysis and Hypotheses for Teacher Guidance Derived from Analysis.

Six children were selected for case studies. They were typical of their age, three boys and three girls, ranging in age from three to five years, each representing a different position in his family. They were typical of the children whom the students would meet when they became teachers.

School observations, anecdotes, reports of physical examinations, teacher reports, parent conferences and home visits constituted the sources of data. The procedures for collecting data were those available to any teacher.

The data were organized into case studies which culminated in a summary. Hypotheses derived from the case study were suggested, pointing up the areas of behavior where the child seemed to need help from the teacher. Ways of testing these hypotheses were indicated.

The manual contained a design for the case studies, the studies themselves and suggestion for teacher guidance.

The second problem, the use of the case study material with students, was dealt with in three ways. First, was the presentation of cases to undergraduate courses at Brooklyn College. Tape recordings of these discussions were presented with explanatory comments. Secondly, their use by a course of beginning teachers was described. They utilized the design of the case studies in compiling cases on children from their respective classes. The third use was with teachers in the nursery school who used the categories as an outline for writing progress reports on children.

The evidence from these uses suggested:

(1) With leadership, students were able to analyze the child's behavior by categories from the records.

(2) Although they tended to infer causes and make subjective generalizations they could be helped to describe the child's behavior objectively.

- (3) Experienced teachers, using the categories, were able to analyze children's behavior objectively and to make hypotheses regarding their needs through observations rather than subjective feelings.

The conclusion of this project was that case studies, compiled by this design, were helpful to students in determining and accepting children's needs. The project makes a contribution by adding to the literature a manual of case studies of nursery school children which can be used as a teaching instrument for students.

276 pages. \$3.45. Mic 56-461

A PROPOSED SCIENCE PROGRAM FOR GENERAL EDUCATION AT CASTLETON TEACHERS COLLEGE, CASTLETON, VERMONT

(Publication No. 15,554)

Richard Alexander Sleeman, Ed.D.
New York University, 1955

GENERAL STATEMENT

It was the purpose of this study to determine what type of science program should be offered for general education at Castleton Teachers College, Castleton, Vermont. In order to propose a science program for general education, it was necessary to:

1. Evaluate the present science program
2. Determine the criteria for general education
3. Determine what the program of general education should be.

EDUCATIONAL SIGNIFICANCE OF THE PROBLEM

A determination of a science program for general education at Castleton Teachers College might serve as a guide for other studies in the area of general education. It also can be a possible source of suggestion to other institutions who may be contemplating changes in their present science programs.

INCIDENCE OF THE PROBLEM

The investigator began this study as a result of an evaluation of Castleton Teachers College by the New England Association of Colleges and the American Association of Colleges for Teacher Education. Their findings indicated that the present science program needed a revision in the light of current trends.

PROCEDURE USED IN COLLECTING DATA AND THE TYPES OF DATA COLLECTED

In general, the investigator collected, summarized and analyzed data found in books, catalogues, journals and other periodicals, and reports of various commissions and committees in the fields of science and general education. Questionnaires and interviews were also utilized for collecting data. On the basis of established criteria, a

number of problem-areas indigenous to Vermont were evolved as the basis for the proposed science program for general education at Castleton Teachers College.

CONCLUSIONS

In the light of the findings presented in the study, and in keeping with the scope, procedure and limitations of the investigation, the following conclusions seem to be warranted:

1. There is a need for a science program designed for general education at Castleton Teachers College since it has been shown that the present one does not meet the criteria of general education as stated in the project.
2. Immediate implementation of the proposed science program may develop a better understanding of scientific concepts; may lead to a better understanding and control of the natural environment; and may develop more lasting interests and attitudes. The results of the proposed science program should have practical application and should contribute to critical thinking.

RECOMMENDATIONS

This study led to the general recommendation that, in teaching the proposed science program, more attention be paid to the needs of the learner, to the problems which confront the people of Vermont, to providing for a variety of first-hand experiences for the students, and to the social implications of science. For purposes of general education, it is recommended that the proposed science program be used because it may help develop interest on the part of the students, may lead to a functional understanding of science concepts, may demonstrate possibilities of practical application, may lead the student to understand his environment better, and may contribute to critical thinking by presenting vital problems in relation to the life of the people in Vermont. For these reasons, it would seem wise to incorporate it into the curriculum at Castleton Teachers College.

202 pages. \$2.53. Mic 56-462

AN ANALYSIS OF AN UNDERGRADUATE PROGRAM IN HUMAN DEVELOPMENT EDUCATION BASED ON THE CHILD STUDY PROGRAM OF THE INSTITUTE FOR CHILD STUDY AT THE UNIVERSITY OF MARYLAND

(Publication No. 15,483)

John Albert Visceglia, Ed.D.
University of Maryland, 1955

Supervisor: Dr. Walcott H. Beatty

Purpose:

The in-service teacher-education program of the Institute for Child Study at the University of Maryland represents a comparatively new approach in the field of human development education. The success of this program has been established by a number of research studies. This

success has given rise to speculation as to whether this program might also be feasible for use with undergraduates, especially in teacher-training. The purpose of this study is to evaluate a program in human development education, based on the program of the Institute for Child Study, and adapted for use with undergraduates in teacher-education.

Procedure:

The program indicated above was developed and used as the curriculum for a course taught to pre-service teachers. Seventy-four freshmen at a New York State Teachers College were used as subjects. Three hypotheses were tested: (1) By means of keeping an anecdotal record through time on a "live" child, the program results in an increased ability to record data in an objective manner, free of judgmental opinions and personal reactions, (2) the program results in an increase in the students' knowledge and understanding of the scientific facts, concepts and principles which explain human development, (3) the program will increase students' skill in relating appropriate scientific principles to specific behavior for purposes of interpretation.

Four measuring instruments were used: (1) the case records written by the students as part of the course (2) two standardized instruments developed as part of the Syracuse Series in Human Development - KNOWLEDGE OF FACT AND PRINCIPLE IN HUMAN DEVELOPMENT and CASE OF SAM SMITH (3) the CASE OF BECKY JACOBS, an unpublished instrument developed at the Institute for Child Study.

The data was obtained on a pretest-post-test design. The hypotheses were tested by the measuring of the significance of differences between results on the before-and-after test series. The statistical methods employed were chi square and t-test.

Findings:

The consistency of the statistically significant differences, generally at the one-half per cent point, found in comparing the pretest to the post-test scores justifies accepting all hypotheses as being substantiated. This is interpreted to mean that the organization of the program developed for this study is essentially sound and effective in accomplishing the aims of human development education as expressed in the hypotheses which were tested, especially for teacher-training undergraduates.

140 pages. \$1.75. Mic 56-463

ADMINISTRATORS' STEREOTYPE OF THE HIGH SCHOOL HOME ECONOMICS TEACHER

(Publication No. 15,287)

Emma May Brittin Whiteford, Ed.D.
University of Illinois, 1955

This thesis was based on the assumption that administrators' stereotypes of typical high school teachers may contribute to the understanding of two important problems in home economics. These problems are concerned with the attraction of capable students into home economics and

the achievement of satisfying adjustment to encourage teachers to remain in the profession.

Stereotypes may be described as fixed beliefs which are not necessarily factual and result from defining first and observing afterward. However, in operational terms, stereotypes may be defined as the extent of agreement among informants from one group in attributing characteristics to other groups. A random sample of high school administrators in Illinois was asked to describe typical female teachers of home economics, business education, English, physical education and social studies as administrators generally think about them. Through the use of an original instrument, the Teachers' Characteristics Inventory, each administrator described the home economics teacher and two of the four other types of typical teachers.

Responses from 272 administrators were studied for evidences of stereotypes and then analyzed in terms of content, distinctiveness and clarity. The information sheet, describing the administrators' professional experience, provided additional pertinent data which also were analyzed to substantiate the presence of stereotypes and to determine their clarity.

Although the responses were received from individual administrators, they were analyzed in terms of pooled data. Inasmuch as individual differences were largely ignored, the findings should be interpreted in general terms rather than applied to a specific individual or situation. These findings are reported only as the present analysis of the data warrants. Additional analyses are to be undertaken later.

The presumption of evidences of stereotypes, based on the results of the tests of the theoretical and observed frequency distributions, led to the conclusion that these administrators had reported evidences of stereotypes. Regardless of the number of teachers reported as known by administrators their descriptions reflected a common knowledge of the stereotypes. Similar evidences of stereotypes were reported by administrators whether or not they expressed difficulty in describing the five types of teachers.

Content of stereotypes consists of those characteristics describing teachers upon which there is substantial agreement among administrators. Within the limitations imposed by the use of ninety selected traits from which administrators could choose, the content of the stereotypes consisted of a pool of thirty-eight characteristics which were significant at the five per cent level and described one or more of the typical teachers. In comparing the profile of the home economics teachers with those of the other four typical teachers, principals checked the following examples as statistically significant traits: motherly, artistic, feminine, capable, conscientious and enthusiastic. Some of these traits for the home economics teacher also describe one or more other teachers.

Distinctiveness is the extent to which terms describing one teacher differ from those describing another teacher. As shown by the D statistic, the stereotypes of business education and home economics teachers were most similar, while those of the English and social studies teachers ranked next. At the other end of the continuum were the stereotypes of typical physical education and social studies teachers. Least similar were the stereotypes of the physical education and English teachers.

Clarity was defined as the extent of agreement among

administrators in assigning characteristics to different teachers. Although the limits of the clarity measure ranged from 2.5 for the clearest stereotype to 45 for the least clear, the obtained values ranged from 8.6 for social studies to 10.0 for home economics. On the whole, the findings indicated that the clarity of the stereotypes was only 25 to 29 per cent as definite as the stereotypes might possibly have been.

The implications of this study suggest that inasmuch as the principal in the high school is both the status and the educational leader, the stereotype he holds of the typical teacher in the selected subject matter areas might be expected to affect the guidance he provides to both pupils and teachers. For example, the perception on the part of the pupil of the principal's stereotype of the home economics teacher might be expected to influence her decision as to whether or not she studies home economics in college. At the same time, consciously or unconsciously, the teacher's perception of the administrator's stereotype of her might be expected to affect her concept of herself and her adjustment to her profession. 118 pages. \$1.48. Mic 56-464

A PROCEDURE FOR TEACHING LOCAL COMMUNITY HEALTH PROBLEMS

(Publication No. 15,288)

Charlotte Elizabeth Wilcox, Ed.D.
University of Illinois, 1955

Health problems are deeply rooted in the culture of every community and can be solved only through social action. Health problems can never be successfully resolved unless each generation learns how to identify them and how to work toward their progressive solution.

Because of the complexity of the task of identifying health problems and securing local data, the textbooks are widely used as the only means for teaching community health. In spite of outstanding progress in developing procedures for identifying and studying personal health problems, little has been accomplished toward furnishing teachers with a workable, precise procedure for identifying and studying community health problems.

The need for a procedure for teaching local community health problems can no longer be ignored. Such a procedure must meet at least four criteria in order to serve the needs of teachers. These four criteria are: precision, conciseness, adaptability, practicability.

Chapter I describes how such a procedure was developed in McLean County. The five steps of its development include: (1) the identification of local community health resources, (2) the identification of local community health problems, (3) structuring the local health problems, (4) gathering data according to categories on procedural charts, and (5) compilation of the data into a concise, usable form.

The procedural charts are presented in Chapter II and directions for using them precede the charts. In the four columns of these charts are found the procedures and community resources necessary for studying local community health problems. The sub-problems along the left margin of the charts show teachers the main sub-divisions of these community health problems. Four main aspects

of these problems (technical, economic, sociological, psychological-educational) are listed across the top of each chart and under these are placed the procedures which teachers may use to gather data in the community with their students. Teachers will need to consider the nature of the community and the maturity of the students when selecting appropriate procedures to be used.

Sample data sheets are included in Chapter III. These data were secured in McLean County as a result of using the procedural charts. They were organized according to the same sub-problems and four social aspects as were the health problems. Then these data were condensed and compiled in a concise form. A code system was devised for referring the reader from a specific procedure on the procedural chart to its corresponding sample data secured in McLean County.

The procedural charts and data sheets offer teachers an efficient and workable procedure for teaching local community health problems. Teachers may employ the charts and data sheets just as they are if they so desire, or the procedural charts and data sheets are easily adaptable to changes if the teacher feels that such are necessary. By using the procedure teachers and students should be able to study local community health problems in a way that will be educationally rewarding.

173 pages. \$2.16. Mic 56-465

EDUCATION, THEORY AND PRACTICE

THE EFFECTS OF TEACHER ATTITUDES TOWARD LEARNING THEORIES AND TOWARD CHILDREN ON PUPIL ACHIEVEMENT IN FOURTH GRADE ARITHMETIC AND READING

(Publication No. 14,515)

Philip Stanley Anderson, Ph.D.
University of Minnesota, 1955

Adviser: Dr. Guy L. Bond

The purpose of this experiment was to determine the differential effect of teacher attitudes toward pupils and toward learning theory on pupil achievement in fourth grade reading and arithmetic.

The criterion of pupil achievement used was measured pupil status at the end of an experimental period of one school year, holding constant the factors of pupil intelligence and initial status. Pupil status in arithmetic was measured by the Analytical Scales of Attainment in Arithmetic, Part II, "Problem Solving", and Part IV, "Fundamental Operations". Gates Basic Reading Tests, Type A and Type D, were used to measure achievement in reading. Intelligence was measured by the Kuhlman-Anderson Intelligence Tests, Fifth Edition, Grade IV.

Teacher attitudes toward pupils were measured by the Minnesota Teacher Attitudes Inventory. The Methods Survey, a test built for this experiment, was used to measure teacher attitudes toward learning theory.

The population used in the experiment was twenty-one fourth grade classes from St. Paul, Minnesota. Sixteen of

these classes, representing eight teachers at each extreme, were used for the MTAI portion of the experiment. For the learning theory portion of the experiment, all twenty-one classes were used. In dealing with arithmetic achievement, ten were classified as being taught by a meaning method teacher, 5 by a neutral method teacher, and 6 by a drill method teacher. For reading achievement, ten were classified as being taught by a meaning method teacher, 7 by a neutral method teacher, and 4 by a drill method teacher.

The first pooling step was to test the homogeneity of final status scores of the sexes. An approximation technique of analysis of variance which tested the null hypothesis regarding sex and class means simultaneously was used. Where the null hypothesis was rejected, further pooling attempts involved the use of Bartlett's test for homogeneity of variances.

Classes were pooled on the basis of final status to make the following comparison groups for both arithmetic and reading:

1. High MTAI teachers versus low MTAI teachers.
2. Meaning method teachers versus neutral method teachers.
3. Meaning method teachers versus drill method teachers.
4. Neutral method teachers versus drill method teachers.

The Johnson-Neyman technique was applied to the groups obtained to ascertain whether the null hypothesis in pupil achievement under teachers differing in the selected attitudes was to be rejected or accepted.

Conclusions drawn from these comparisons are:

1. On the measures of arithmetic achievement used, neither teacher attitudes toward pupils nor teacher attitudes toward learning theory had any influence on pupil achievement.
2. On the measures of reading used, there was no difference in the achievement of pupils under teachers scoring high on the MTAI as against pupils under teachers scoring low on the MTAI other than the possibility of a tendency for high MTAI teachers to maximize sex differences.
3. On those measures of reading where teacher attitudes toward learning theory did make a difference in pupil achievement, meaning method teachers were more effective with pupils of high ability while drill and neutral method teachers were more effective with pupils of low ability.
4. Observations regarding sex differences indicate that a meaning method approach to reading instruction tends to produce greater variability in the final status of boys.

297 pages. \$3.71. Mic 56-466

THE DEVELOPMENT OF AN INSTRUMENT FOR MEASURING CHILDREN'S KNOWLEDGE OF BASIC SOCIAL EDUCATION PRINCIPLES AS THESE APPLY TO SPECIFICALLY DESCRIBED LIFE SITUATIONS

(Publication No. 15,029)

Kenneth T. H. Brooks, Ed.D.
Boston University School of Education, 1955

STATEMENT OF THE PROBLEM

The purposes of this study were: (1) to develop an instrument that would reveal eighth grade children's knowledge of basic social education principles, and (2) to determine the variations in the patterns of responses as manifested by groups of varying composition.

RESEARCH PROCEDURES

A. The Determination of the Principles to be Tested. In the construction of the testing instrument, twenty-four basic principles were used as guides. These principles are the "Characteristics of A Good Citizen" determined in a study conducted by the National Council for the Social Studies.¹

B. The Construction of the Test.

1. Writing of items: Situations, translating one or more of the principles into action were written by teachers and children, as well as the author. Four responses were given with an opportunity for write-in responses provided.

2. Content validity. The entire instrument was submitted to a panel of experts, composed of twelve eighth grade teachers, a school social worker, and six college instructors in the fields of education, social science, and psychology.

3. Readability of the test. Following a try-out of the test, each item was checked for its readability. For this purpose the Lorge Readability Index² was employed. An application revealed indices ranging from a low of 3.7 to a high of 5.6 with a median of 4.6.

4. Selection of Population and Administration of Test. Six hundred and fifty eighth grade children in four communities in New England, each of varying ethnic characteristics, were employed in this study. In addition, 49 adjudged delinquent boys from the Meriden, Connecticut State School for Boys, participated. A third group of 55 children was extracted from the cross-sectional group, by vote of its members. They were selected as most representative of the good citizen.

In the final administration, stanine scores for Intelligence and for a partial battery of the Advanced Stanford Achievement test were included on each student's test.

Complete anonymity of the respondents was maintained.

ANALYSIS OF THE DATA

A. Distribution of Scores.

The raw scores ranged from a low of 10 to a high of 56 (out of a possible 57). The mean score for the boys was 43.47 with a standard deviation of 9.87. For the girls the mean was 47.63 and the standard deviation 5.46. The Delinquent group had a mean of 44.65; and a standard deviation of 11.04; the High Morale group, a mean of 46.89 and a standard deviation of 8.51.

B. Difficulty and Discrimination Indices.

The indices of difficulty determined for each item separately ranged from a low of .49 to a high of .99⁺, with a median of .83 for the boys. The girls ranged from a low of .56 to a high of .99⁺, with a median of .91.

Discrimination indices were also determined for each item separately. These ranged from a low of .38 to a high of .77 for the boys, and from a low of .32 to a high of .66 for the girls. The boys' median was .58 and the girls' .51.

C. Reliability of the Test.

Reliability coefficients of .825 for the girls and .927 for the boys were attained upon an application of the Kuder-Richardson formula for test reliability, #20.

D. Community Comparisons.

Before community comparisons were made, raw scores were converted to stanine scores in order to cancel out existing sex differences.

1. Correlations.

Correlations were made separately by community between the writer's test and Intelligence, Paragraph Meaning, Word Meaning, Arithmetic, and Social Studies. The correlations ranged from a low of .15 to a high of .51. All correlations, with the exception of Arithmetic in Community I and Paragraph Meaning in Community IV were significantly above .00 at the 1 per cent level of confidence.

2. Analysis of Community Means.

An application of the "t" test of significance of uncorrelated means, revealed that one community (Community II) had a significant difference at the 1 per cent level of confidence.

CONCLUSIONS

The vast majority of eighth grade children in this study possess the knowledge of basic social education principles required of good citizens as described by the National Council for the Social Studies.

No significant difference in total test scores was manifested between the three groups in the study.

The children in this study did not discriminate against people of other colors.

Conflicts between existing social standards as taught by the schools and as taught by the home were prevalent.

The children in this study were reluctant to inform proper authorities concerning an offense when a colleague or acquaintance was involved.

Differences were manifested in situations involving the strict adherence to the law when personal sacrifices were involved.

Write-in responses revealed that delinquents knew correct responses but were inclined to use more aggressive techniques to insure the acceptance of their beliefs than did non-delinquents.

In some situations on this test the students, at times, placed personal interests above group welfare, and rejected the democratic process in arriving at group decisions.

The instrument developed in this study had low but positive correlation with Intelligence and academic achievement. Although positive, they were not of such a magnitude to indicate that intelligence and achievement conditioned the responses on the Brooks' test.

LIMITATIONS OF THE STUDY

The entire population was drawn from the New England area. No conclusion can be claimed as representative of any area except this one.

The decided negative skewness of the distribution of scores indicates the comparative simplicity of the Brooks' test.

No indication of the type of offense for which each member of the delinquent group was assigned to the School for Boys was available. It is possible, although highly improbable, that the sample included in this study may have represented only one type of misdemeanor or felony.

156 pages. \$1.95. Mic 56-467

1. National Council for the Social Studies, "Are You a Good Citizen?", N.E.A. Journal, November 1950, pp. 612-614.

2. Irving Lorge, "Predicting Readability", Teachers College Record, March, 1944, pp. 404-419.

AN EXPERIMENTAL STUDY COMPARING THE EFFECTIVENESS OF TWO PATTERNS OF TEACHING HIGH SCHOOL VOCATIONAL AGRICULTURE PUPILS TO SOLVE SPECIFIC FERTILITY PROBLEMS

(Publication No. 15,501)

Harold Wadsworth Miller, Ph.D.
Cornell University, 1955

The purpose of this study was to measure the comparative effectiveness of the conventional pattern of teaching used throughout New York State and an experimental pattern of teaching which had been developed at Cornell University.

Two groups of fifteen teachers each taught units on fertilizing wheat, hay fields, spring grains and corn. The wheat unit was used as a part of the training program. Pupils were pre-tested and post-tested with a Fertility Test and A Test on the Process of Solving Fertility Problems which were developed and tested by the investigator. After sample questions had been tested in the field, the Fertility Test was constructed. Curricular validity was further determined by staff members in agronomy and in agricultural education. Item analysis was carried out by using 205 pupils of vocational agriculture who had had some training in fertilizing those crops. The Fertility Test in its final form gave a coefficient of reliability of .864 using the split-half technique when the test was administered to 160 pupils. A Test on the Process of Solving Fertility Problems was judged for validity by staff members in agricultural education and eight graduate students. Using the split-half technique, the final revision showed a coefficient of reliability of .804 when administered to 166 pupils of vocational education.

An evaluation scale for grading pupil plans was also

developed and tested. Validity was judged by staff members in agricultural education and sixty teachers of Vocational Agriculture. Reliability was measured by using five judges working separately with the investigator.

The two groups of pupils were equated on the basis of mental and reading abilities plus pre-test scores where possible; grade in school was used to replace mental or reading abilities as controls for those stratifications dealing with reading or mental ability.

Pupils were stratified on the bases of status in farming, intent to farm, opportunity for placement on the home farm, and reading and mental abilities. Although all thirty teachers completed the four units, two experimental teachers were excluded on the basis of not having followed the experimental pattern while one of the conventional group was excluded on the basis of not having followed directions in the testing program.

The multiple-classification analysis of covariance was used as the statistical technique for treating the data.

The experimental pattern of teaching proved highly superior to the conventional pattern when pupil progress was determined by the quality of farm plans they produced; every stratification of pupils showed highly significant F values in favor of the experimental pattern. When pupil progress was measured by A Test on the Process of Solving Fertility Problems the stratifications based on intent to farm and opportunity for placement in farming on the home farm showed significant F values in favor of the experimental pattern. The results of measuring pupil progress by the Fertility Test gave no significant F values for either pattern of teaching. Therefore under the experimental pattern the ability to recall facts, knowledge and understandings as measured by the Fertility Test was equal to the recall of pupils under the conventional pattern, two stratifications excelled under the experimental pattern in the process of solving fertility problems, while all stratifications of pupils excelled under the experimental pattern in terms of the quality of farm plans produced.

309 pages. \$3.86. Mic 56-468

ENGINEERING

ENGINEERING, GENERAL

THE COMPARATIVE ACHIEVEMENT OF ENGINEERING STUDENTS WHO ENTER THE INSTITUTE OF TECHNOLOGY DIRECTLY FROM MINNESOTA HIGH SCHOOLS WITH THOSE WHO SECURE THEIR PRE-PROFESSIONAL EDUCATION IN MINNESOTA JUNIOR, LIBERAL ARTS, AND TEACHERS' COLLEGES

(Publication No. 14,535)

Sterling Bowman Mitchell, Ph.D.
University of Minnesota, 1955

This normative study compared achievement in upper division engineering curricula between students who entered engineering directly from high school and those who transferred from other institutions with advanced standing. The samples entered the Institute of Technology (University of Minnesota) between 1947-49 for natives and 1949-52 for transfers.

The groups were compared on the American Council on Education Psychological Examination (ACE), high school rank (HSR), and amount and quality of work completed expressed in honor-point ratio (HPR) in the Institute when matched on ability and time of transfer. Two stratified random samples were drawn in terms of ability and length of stay in college with proportionate representation in the same ratios as they appeared in the original samples. HPR for the stratified native sample were recomputed on the basis of work taken beyond the median credits transferred by the transfers and were denoted as terminal HPR. Null hypotheses were proposed and analyses included current methods of statistical treatment.

Findings: (1) No significant differences were noted between the major groups on ACE and HSR. (2) Between one-quarter and one-third of both groups graduated from engineering while over one-third of each did not complete one year's work. (3) No differences in persistence in engineering study were noted between groups when categorized by high, middle, and low ability on ACE. (4) When comparisons were made on HPR in the Institute between major groups no significant differences were noted, a condition which continued when adjustments were made for ACE and HSR, singly or in combination. (6) A direct relationship existed between groups on HPR in the Institute and length of stay in college. (7) Comparisons between stratified samples of natives and transfers revealed no differences on ACE, HSR, and terminal HPR, or on terminal HPR when adjustments were made for initial differences on ACE or HSR. Comparisons between ability groups did reveal significant differences for ACE, HSR, and terminal HPR. When classified by length of stay no differences were noted for ACE or HSR but were observed for terminal HPR.

Conclusions: (1) Natives and transfers were apparently from the same high school population. (2) Screening procedures in transfer institutions were similar to that done in lower division work in the Institute as evidenced by comparability on ACE, HSR, and persistence in school. (3) Natives and transfers tended to persist at approximately the same rate for various levels of length of stay irrespective of ability. (4) High mortality was noted for both groups with equally able students being eliminated almost as often as those with less academic promise, indicating that ACE and HSR were not good predictors of success in engineering. (5) Comparable groups of natives and transfers appeared to attain similar success in advanced engineering curricula. Their scholastic records were similar even when adjustments were made for ACE and HSR. Although length of stay was not affected by ACE or HSR, there was a direct relationship between terminal HPR and length of stay. (6) Differences were noted among transfer institutions with junior college representatives being the most able on ACE, transferring the most credits, remaining in the Institute the longest period of time, and earning the highest HPR. (7) Students who took pre-engineering work in other institutions were approximately as successful in upper division work in the Institute as their native counterparts.

Recommendations: (1) Schools of engineering and local institutions should continue to cooperate in joint programs for engineering training. (2) High school graduates aspiring to engineering careers should be encouraged to enter local institutions for pre-engineering training with subsequent transfer to specialized curricula. (3) Continuous efforts should be made to improve selection and screening procedures for engineers to reduce high mortality. (4) Further research might well investigate these comparisons when applied to the various branches of engineering education. 202 pages. \$2.53. Mic 56-469

ENGINEERING, AGRICULTURAL

METHODS OF OBTAINING BETTER PERFORMANCE WITH CAPILLARY TUBE EXPANSION FOR BULK MILK COOLERS

(Publication No. 15,677)

Leon Francis Charity, Ph.D.
Cornell University, 1956

A capillary tube in a refrigerating system is the ultimate in its simplicity. It is simply a small bore tube connecting the high pressure side of the refrigerating system to the low pressure side.

During the last four years, several manufacturers have used capillary tube expansion in farm type bulk milk coolers. A great many of these coolers in New York State have air-cooled condensing units which are required to operate in a wide range of milk-house air temperatures.

The pressure difference across the ends of the capillary tube is directly effected by changes in air temperature, which effect the rate of refrigerant flow to the evaporator. Therefore, it seemed desirable to know if satisfactory performance of such a refrigerating system exists under the variable conditions usually found in New York State milk-houses.

An ice-bank type of bulk cooler was selected for the study instead of a direct-expansion type because of the long periods of condensing unit operation, ease of modification of the evaporator, and the ease of viewing and photographing the refrigeration in the form of an ice-bank.

Bracketing the thirty-three ounce F-12 refrigerant charge recommended by the manufacturer, charges of thirty, thirty-two, thirty-four, and thirty-six ounces were respectively placed in the refrigerating system and the cooler performance tested throughout the ambient temperature range of 35 to 95 F in ten degree steps. One series of tests involved a nine-hour condensing unit operation, and another allowed the ice-bank control to limit ice production. The capillary tube refrigerating system studied was found to have a very critical refrigerant charge which lies between thirty-two and thirty-three ounces.

For the nine-hour operation ice harvest in pounds was quite satisfactory, particularly from 35 to 75 F ambient temperature. However, with the ice-bank control operation, ice harvest was considerably less in this temperature range. The conformation of the ice-bank was different at each test temperature, with a fairly even distribution of ice over the evaporator coils at the higher temperatures and a mound of ice near the entrances of the evaporator coils at the lower temperature.

As automatic control of the ice-bank formation is very desirable for a bulk cooler, several devices were tried in an effort to obtain a uniform ice conformation and harvest. A bellows liquid absorber and a canister liquid storage improved performance but only through a narrow ambient temperature range. With the condenser fan operating at 1725 rpm from 75 to 95 F and 860 rpm from 35 to 65 F performance was also improved through a narrow temperature range. Intermittent condenser fan operation gave uniform ice harvest, and conformation. However, the high efficiency that could have been realized with low ambient temperatures was sacrificed.

An auxiliary capillary tube was used in addition to the two tubes incorporated in the original refrigerating system. The flow of refrigerant through this third capillary tube was controlled by a thermostatically operated solenoid valve. The valve opened in the temperature range of 35 to 65 F and resulted in a satisfactory ice conformation, larger ice harvest, and a greatly improved efficiency. This device extended more uniform performance through the entire ambient temperature range of 35 to 95 F.

184 pages. \$2.30. Mic 56-470

ENGINEERING, CHEMICAL

THE INFLUENCE OF VARIOUS MOLECULAR STRUCTURES ON THE ELIMINATION MAXIMUM OF FATTY ACIDS

(Publication No. 15,616)

George John Demakis, Ph.D.
Virginia Polytechnic Institute, 1955

This investigation was made to study the effects of molecular structure on the elimination maximum of fatty acids. Such molecular structural variations as chain length, presence and position of double bonds, conjugation and unconjugation of the double bonds, and positional and cis-trans isomerism were studied.

The centrifugal molecular still with a five-inch rotor and a bell-jar condensing surface available at the beginning of this investigation was almost completely reconstructed to improve ease of operation and maintenance of a vacuum-tight system. Final design included a magnetic drive to replace the vacuum-enclosed drive and packed-shaft drives used in previous investigations. A water-cooled condensing plate was also incorporated into the system.

Initial tests were made to obtain a constant-yield oil and to standardize an operating technique. A mixture of light and heavy mineral oils and Voltesso No 36 was found to give a satisfactory constant-yield oil. The conditions of operation under the standardized technique were as follows: operating pressure, 12 ± 2 microns of mercury, absolute; feed rate, 60 to 65 milliliters per minute; feed-residue temperature differential, 24 ± 1 degrees centigrade; condenser water temperature, 45 ± 1 degrees centigrade; rotor speed, 1000 ± 50 revolutions per minute; and number of passes of the feed volume over the rotor per distillate fraction, one. The first fraction was collected at a residue or fraction temperature of 86 degrees centigrade and fractions were taken thereafter at six-degree increments up to 140 degrees centigrade.

Fourteen fatty acids were distilled in duplicate tests in the study. Six of these were long-chained saturated fatty acids; pentadecylic, palmitic, margaric, stearic, nonadecylic, and arachidic acids, which varied in the length of the carbon chain from 15 to 20 carbons. The elimination maxima determined for these acids were 100, 102, 110, 112, 127, and 122 degrees centigrade, respectively. Four fatty acids containing one double bond in the molecule were studied and the maxima were found to be as follows: palmitoleic, 99; oleic, 110; elaidic, 117; and vaccenic, 115 degrees centigrade. The elimination maxima of the diethenoids studied, linoleic and 9,11-linoleic acids, were found to be 108 and 116 degrees centigrade, respectively; and those of the triethenoids studied, linolenic and α -eleostearic acids, were found to be 107 and 122 degrees centigrade, respectively.

It was concluded from the investigation that the addition of two CH_2 groups in the carbon chain raises the elimination maximum of even-numbered saturated fatty acids by 10 degrees centigrade, and that a similar addition did not necessarily raise the elimination maximum of the odd-numbered acids by the same amount. Further, it was found that each double bond in an unconjugated position in the fatty acid molecule lowered the elimination maximum from 1 to 3 degrees centigrade. Each double bond added to the molecule in a conjugated position raised the elimination

maximum by 6 degrees centigrade. Both positional and cis-trans isomerism were found to have a pronounced effect on the elimination maximum.

208 pages. \$2.60. Mic 56-471

EFFECT OF OPERATING VARIABLES ON HYDROGENATION OF COTTONSEED OIL

(Publication No. 15,449)

Ibrahim Abdalla Eldib, Ph.D.
The University of Oklahoma, 1955

Cottonseed oil is hydrogenated commercially to produce shortenings and oleomargarine. However, little is known of the reaction fundamentals. The purposes of this study were as follows:

1. To obtain quantitative data for the hydrogenation of cottonseed oil. The effect of temperature, pressure, catalyst concentration, and agitation were studied in regard to selectivity, iso (trans) oleic acid formation, and the rate of hydrogenation.
2. To determine the mechanism of the reaction.
3. To establish the mechanism for selectivity and isomerization.

Thirteen hydrogenation runs were made in a batch-scale dead-end reactor over the following range of operating conditions:

1. Temperatures, 115 to 160°C.
2. Hydrogen pressures, 20 to 140 psig.
3. Catalyst concentrations, 0.03 to 0.15% nickel by weight.
4. Agitation, 550 to 1760 rpm.

Samples were obtained during the course of the reaction at intervals of approximately ten iodine value units. These samples were analyzed for total unsaturation using the iodine value method, for linoleic acid using the ultraviolet spectra, and for iso (trans) oleic acid using the infrared spectra.

The principal findings of this research were as follows:

1. The overall hydrogenation rate for cottonseed oils with iodine values of 80 or less can be correlated within 10% by the following equation when mass transfer resistances are eliminated and the catalyst activity does not change during the course of the reaction:
rate = 0.0000821 (Iodine Value) (P_H , psia) ($T^\circ\text{C} - 103$) (% Ni by weight)
The equation does not predict rate data at an iodine value of 80 or more for most of the runs. This is attributed to the presence of trace compounds (e.g. coloring, flavoring, and odoriferous materials, etc.) which are hydrogenated during the early portion of the reaction.
2. Mass transfer resistances were eliminated in most of the hydrogenation runs made in this study. This allowed for a better insight into the reaction mechanism.
3. Selectivity and iso (trans) oleic acid formation are decreased with increased operating pressure. They are also decreased with increased agitation until mass transfer resistances are eliminated.
4. Selectivity and iso (trans) oleic acid formation are not affected by changes in catalyst concentration as long as the catalyst maintains its activity during the course of the reaction, and mass transfer resistances negligible.

5. Selectivity is not significantly affected by increases of temperature when mass transfer resistances are eliminated. Iso (trans) oleic acid formation is favored by temperature increases.

6. Selectivity and isomerization result from physical adsorption of linoleic acid on the catalyst surface preferentially to oleic acid.

7. Selectivity and isomerization were quantitatively measured using relative reaction rate constants.

8. A mechanism is proposed for the hydrogenation reaction. The surface reaction between chemisorbed hydrogen and physically adsorbed unsaturate appears to be the rate controlling step. 112 pages. \$1.40. Mic 56-472

CONTINUOUS FRACTIONAL CRYSTALLIZATION: THE SEPARATION OF ORTHO AND PARA DICHLOROBENZENES

(Publication No. 15,521)

Landon Reece Nichols, Jr., Ph.D.
Cornell University, 1955

The purpose of this project was to investigate the feasibility of fostering crystal formation from a molten organic mass by direct injection of an immiscible coolant. The ultimate goal was a continuous crystallization process utilizing this method of heat transfer. A mixture of ortho and para dichlorobenzenes was chosen as the organic system.

For the initial work a vertical column with a height of 4 feet and an inside diameter of 33 millimeters was used as the crystallization chamber. The unit was fitted with side arms for the introduction of organic liquid feed, and for the removal of mother liquor, product melt, and coolant. A high-density, calcium nitrate brine was chosen as the cooling medium.

The coolant was injected drop-wise into the molten organic mass at the top of the column and after passing down through the organic phase was continuously circulated and cooled. About 90 per cent of the precipitated para isomer was in the form of small free-forming crystals; the remainder formed a thin crystal coating on the brine droplets. A compacted crystal-brine bed was realized. The bed formation rested on the coolant-organic interface. Melting the crystalline material at the phase boundary resulted in refluxing the crystal-brine bed formation. Continuous removal of a portion of this melt resulted in a product exhibiting a freezing point within 0.5 degree Centigrade of that of pure para isomer when using a feedstock of 80 per cent para dichlorobenzene. During this operation mother liquor removal and coolant injection were controlled to give an average bed height (reflux height) of 2 feet.

A pilot unit utilizing a Pyrex column 8 feet in height and 6 inches in diameter was erected for investigating the influence of increased column diameter on thermal circulation in a settled-bed crystallizer. The extensive thermal circulation in the larger unit make it inoperable and demonstrated that geometrical scale-up factors cannot be based on a unit having a diameter of only 33 millimeters.

It followed from this work that for units of commercial size:

1. Reflux-type operation must be with the heated zone at the top of the unit and some means provided for making crystals rise to the top.
2. Co-current operation introduces no adverse flow conditions.

A detailed study of the co-current type operation was carried out in the pilot unit. The feed phase consisting of 70 per cent para isomer and an immiscible coolant (water) were contacted at the bottom of the cylindrical crystallization chamber. The crystals, so formed, consolidated into a porous crystalline mass in the continuous coolant phase. This porous mass was advanced continuously by the flowing coolant. The coolant and mother liquor were readily withdrawn from a side arm without affecting the moving crystalline mass. The drained crystals emerged as a continuous core from the top of the experimental unit.

The isomeric separation was carried out for three different feed compositions. The results predict that the product from a three stage operation with a feed of dichlorobenzenes having a para content of 70 per cent would yield a product having a para content in excess of 98 per cent.

The rate of filtration of the coolant through the moving crystal bed was the determining factor in loading of the crystallizer. The feed rate to the crystallizer was varied from 342 to 1204 pounds per hour per square foot. The product removal rate varied from 194 to 538 pounds per hour per square foot. 100 pages. \$1.25. Mic 56-473

MULTI-TANK CONTINUOUS FERMENTATION

(Publication No. 15,251)

Joseph Edward Nowrey, Ph.D.
University of Illinois, 1955

The acetone-butanol fermentation was chosen as a model system for continuous fermentation studies because the batch fermentation proceeds in well-defined stages. Moreover, the cultures are known to degenerate on serial transfer, and as a consequence this fermentation has been cited as one which cannot be operated continuously.

By maintaining the organisms in a continuous propagator at a low cell concentration and at a pH above 5.5 it was possible to obtain successful batch fermentations from the culture after two weeks (ca. 650 generations). In a parallel experiment with the same culture, degeneration occurred after four 24-hour serial transfers (ca. 23 generations). These results support the work of Kutzenok and Aschner [*J. Bacteriol.*, 64 829 (1952)] who proposed that the degeneration of the butyl alcohol bacteria on serial transfer is due to the selection of mutants at low pH.

Results from continuous fermentations carried out in one-, two-, and three-tank systems indicate that for continuous operation a two-tank system is the most suitable. Even in the two-tank run, however, the organisms began to lose their ability to ferment sugar after 200 hours of operation; solvent production based on sugar utilized was not impaired. This difficulty was noted only at relatively high sugar concentration. No explanation could be found.

The fact that successful batch fermentations could still be obtained from the culture after 240 hours of continuous propagation suggested that degeneration was not the cause.

Analysis of the data during unsteady-state operation gave insight into the performance of the continuous flow system. For example, in the two-tank run during the period when sugar utilization rate was decreasing, the assumption of a linear rate of decrease with time corresponded very well with experimental results.

No evidence was found supporting the claims that it is necessary to permit the butyl alcohol bacteria to go through all the cycles that occur batchwise. In fact, excellent fermentations took place for several retention times in vessels where the organisms were maintained in a constant environment. 97 pages. \$1.21. Mic 56-474

THERMAL DIFFUSION IN METALS

(Publication No. 15,290)

Fredrick Robert Winter, Ph.D.
University of Illinois, 1955

The study of thermal diffusion in liquid metals was carried out to obtain a better understanding of the molecular energy quantities which are important in determining the equilibrium separation. Dougherty (D-2) recently performed thermal diffusion experiments on organic systems. He found that the thermal diffusion ratio could be expressed with almost the same degree of accuracy using either a constant fraction of the heat of vaporization or by using the activation energy for viscous flow for the pure components. The ratio of the heat of vaporization to the activation energy for viscous flow stays fairly constant at a value of 4 for most organic compounds. This makes the distinction as to which energy quantity is the controlling one in thermal diffusion quite difficult to ascertain from a study of these systems.

With liquid metals, the ratio of the heat of vaporization to the activation energy varies widely from 9.65 for zinc to 69.9 for gallium. It is then possible from a study of thermal diffusion in liquid metals to get a clear cut distinction as to which energy quantity controls the thermal diffusion separation. The following binary systems were studied: tin, cadmium, tin-lead, tin-zinc, tin-mercury, tin-gallium, tin-bismuth, and bismuth-lead. The results of these experiments showed quite strikingly that the activation energies for viscous flow of the pure components govern the equilibrium separation.

Ternary systems of liquid metals involving tin, lead, and bismuth were also studied. It was found that one can obtain an approximate treatment for simple liquid ternary systems by assuming each molecule has an activation energy for molecular motion in the mixture equal to its value in the pure state at the same temperature and pressure.

Measurements of molecular diffusion of thallium through single crystals of zinc were also made. These data were taken to supplement the thermal diffusion in solids data in the author's Master's thesis. From a knowledge of the activation energies of diffusion for thallium through zinc and zinc through zinc, it was possible

to show that thermal diffusion in solids could be described in terms of the theory of activated motion assuming an atom for atom exchange mechanism in the lattice.

78 pages. \$1.00. Mic 56-475

ENGINEERING, CIVIL

SOLUTION OF STRUCTURAL MECHANICS PROBLEMS ON HIGH SPEED DIGITAL COMPUTING MACHINES

(Publication No. 15,189)

John Albert Brooks, Ph.D.
University of Illinois, 1955

Numerical methods of solution and programs for solution of structural mechanics problems on high speed digital computers are described. The methods are applicable to research in the behavior of structures and are not in general intended for direct application to the design of structures. The problems considered involve: determining static deflections, buckling loads, and natural frequencies of structures, and transient response to dynamic loads.

The determination of static deflections of a structure requires the solution of simultaneous algebraic equations. A program for solving simultaneous equations is described. The method of solution is a relaxation procedure which employs an adaptation of the conjugate gradient method for computation of relaxation patterns.

The static buckling problem reduces to the solution of a determinantal equation for the roots, λ , where λ specifies the magnitude of the load on the structure. The determinantal equation is $|A(\lambda)| = 0$, where $A(\lambda)$ is a symmetric matrix whose elements are functions of λ . A program based on Lanczos' method of minimized iterations is described for determination of buckling loads.

The solution to the transient response problem is viewed with the aspect of determining a set of generalized coordinates which permit the dynamics problem to be reduced to a few degrees of freedom. A program for step-by-step numerical integration is described in which the patterns of deflection representing the generalized displacements are supplied as parameters to the program. It is also arranged such that inertia terms may be omitted from some of the equations. The numerical method itself is known as Newmark's β Method.*

An elastic arch is used as an example to demonstrate the applicability of the programs to solution of structural problems. Static deflections, buckling loads, natural frequencies, and the response due to a time dependent load are obtained.

72 pages. \$1.00. Mic 56-476

*Newmark, N. M., "Computation of Dynamic Structural Response in the Range Approaching Failure", Proceedings of the Symposium on Earthquake and Blast Effects on Structures, UCLA, June 1952.

CUMULATIVE DAMAGE IN THE FATIGUE OF STRUCTURAL JOINTS

(Publication No. 15,205)

James Robert Fuller, Ph.D.
University of Illinois, 1955

Engineers have often questioned the applicability of constant-cycle fatigue test results to actual structures where the loads vary from cycle to cycle in a more or less random manner. This study was carried out to investigate the fatigue lives of structural joints which had been subjected to variable cycles of loading.

For this investigation it was assumed that the fatigue lives of actual structural joints could be ascertained by the application of a pattern of maximum cyclic stresses where the various cyclic stress magnitudes occurred with the same frequency as the service stresses. Furthermore, it was assumed that the order of application of the stresses within the pattern was not important if the pattern was repeated a sufficiently large number of times before failure. With these assumptions an empirical method was derived from data of previous investigations to estimate the fatigue lives of structural joints in service.

In the proposed method the interval of possible cycles to failure for a variable-cycle loading pattern is determined for the greatest and least maximum cyclic stresses from the constant-cycle S-N diagram. Then the number of cycles to failure within the interval is ascertained by using a distribution coefficient, β , which associates the variable-cycle pattern with the endpoints of the interval on the basic S-N diagram.

The predicted variable-cycle fatigue lives for the structural joints tested in this investigation are in good agreement with the test data.

91 pages. \$1.14. Mic 56-477

SETTLEMENT DUE TO BUILDING CONSTRUCTION IN CHICAGO

(Publication No. 15,228)

Herbert Orin Ireland, Ph.D.
University of Illinois, 1955

This thesis is based on data collected by the Joint Committee on Soil Mechanics and Foundation Engineering, a committee of the Illinois Section of the American Society of Civil Engineers, the Western Society of Engineers and the Engineering Experiment Station of the University of Illinois. Its primary purpose is to present a quantitative summary of the actual settlements associated with building construction and especially foundation construction in Chicago. A secondary purpose is to establish a relation between observed settlement and the type of construction activity responsible.

The study includes the analysis of level readings on about 2400 reference points located adjacent to 42 building construction sites. Most of these sites were located in the Central Business District of Chicago where similar soil conditions prevailed. A typical soil profile consists of:

| | |
|------|---------------------------------------|
| 8 ft | Miscellaneous fill |
| 6 | Sandy gray inorganic silt |
| 3 | Stiff blue and yellow clay |
| 43 | Compressible blue clay |
| 20 | Stiff to very stiff blue clay |
| 9 | Very hard unsaturated gray clay |
| 7 | Waterbearing sand, silt, and boulders |
| | Bedrock (Niagaran limestone) |

Of the buildings under construction, 70.3% were founded on caissons, 27.3% on piles and 2.4% on spread footings. Most of the buildings under observation were founded on spread footings.

The data were separated into four major categories based on the type of foundation under construction (piles or caissons) and the type of foundation for buildings under observation (spread footings, piles or caissons). The observations on buildings founded on spread footings adjacent to construction on caissons were separated into groups based on whether the building under construction had one, two, or three or more basements. For each of these conditions, the observed settlement was plotted with respect to the distance of the reference point from the new excavation.

It was found that the settlement caused by construction on piles or caissons with one basement seldom if ever exceeded 3 in. When two basements are to be constructed, more than average care is required to keep adjacent settlements under 3 in. and the construction of a building with 3 or more basements in Chicago may be a hazard to adjacent structures within a distance of about 75 ft. The study leaves little doubt that the depth of excavation is a major factor in determining the settlement of adjacent structures, and that some settlement is inevitably associated with caisson foundations.

134 pages. \$1.68. Mic 56-478

A STUDY OF THE RESISTANCE OF MODEL FRAMES TO DYNAMIC LATERAL LOAD

(Publication No. 15,241)

Robert John Jacob Mayerjak, Ph.D.
University of Illinois, 1955

The resistance of model steel frames subjected to dynamically applied lateral loads which produce large deflections (nearly 30 times the elastic limit deflection) is studied. The results of static and dynamic tests are presented; these provide a basis for the comparison of the dynamic with the static resistance of model frames.

The models used in these tests were made from ASTM A-7 steel and were machined to be approximately 1/4 scale replicas of a standard 6 WF 25 section. In all of the tests the sections were tested in their strong direction of resistance. There were two center loaded simple beam tests, one third point loaded simple beam test, four rigid top girder frame tests, and six flexible top girder frame

tests. In two of the flexible top girder frame tests, axial loads were applied to the columns of the frames in addition to the lateral load. The rigid top girder frames were square bents approximately 15 in. by 15 in. The flexible top girder frames were rectangular bents approximately 16.5 in. high and 30 in. long.

The experimentally determined resistance functions for the frames tested in this investigation are in good agreement with those theoretically predicted. It was found that the characteristics of the resistance function for dynamic loading conditions can be explained and predicted by a simple, linear strain theory of plastic deformations that makes use of the stress-strain properties which are in accord with those determined from investigations of the dynamic properties of tensile coupons.

Relationships for estimating the resistance function of full sized structures subjected to dynamically applied loads are developed. The procedures are based on dimensionless relationships which enable one to concentrate quickly the angle change in a member subjected to large inelastic deformations. When this is done, the load-deflection analysis can be made by conventional procedures.

106 pages. \$1.33. Mic 56-479

THE DETERMINATION OF MOMENT DISTRIBUTION CONSTANTS OF MEMBERS WITH A VARIABLE MOMENT OF INERTIA

(Publication No. 15,332)

Otakar Ondra, Ph.D.
Lehigh University, 1955

In applying the Cross method of moment distribution to a given structure several factors or constants must be determined before the process of balancing moments can be carried out. In general these constants include fixed end moments due to loads and impressed distortions, carry-over, stiffness and distribution factors, shear and thrust stiffness, flexibility, etc.

The dissertation describes and illustrates by means of examples an experimental method of determining these constants for beams and symmetrical arches with variable moments of inertia. The method is based on the concept of a three-dimensional M/EI -solid whose properties are functions of the loads, slopes, and deflections of the related statically indeterminate member. It is shown that each of the moment distribution constants is a function of a ratio J/Q which also defines the location of the center of gravity of the M/EI -solid. To evaluate the ratio experimentally, the solid is fashioned from wood or other suitable material which can be readily cut or molded. The solid is simply supported and the end reactions are determined by weighing. The location of the center of gravity is then found by statics.

The average error in twelve carry-over and stiffness factors determined both experimentally and analytically was 3.1 per cent. A relationship between the carry-over and stiffness factors for a beam permits an adjustment of the experimentally determined factors, if larger errors exist. It is pointed out that the experimental method is theoretically correct and can be arbitrarily accurate inasmuch as the accuracy of results for both beams and

arches depends entirely on the lineal scale of the M/EI -solid. Small solids, such as can be made inexpensively and rapidly from small pieces of wood, were used in the experiments to demonstrate the usefulness and reliability of the method for structural design purposes.

Arches are particularly scale-sensitive. An alternate method is developed whereby the arch properties are represented by two straight-axis solids. The latter are fashioned and weighed in a manner similar to that developed for beams. As a result the accuracy of arch results thus determined is comparable to that obtained with beams.

It would appear that the principal advantages of the experimental method are as follows:

- (1) In general the moment distribution constants can be determined reliably and fairly rapidly.
- (2) Solutions obtained by the experimental method are numerically independent of their purely analytic counterpart. Although the same working formulae are used in both approaches, in the experimental method integrals are replaced by areas, volumes, and their moments, determined by weighing.
- (3) The concept of the three-dimensional solid and its reactions is helpful in visualizing the effects of varying span length, moments of inertia, or both on the carry-over, stiffness and other factors. In preliminary analytic work the principle of the proposed experimental method affords a rough estimate of the various factors by means of sketching the respective M/EI -solids. Two-dimensional conjugate beam and moment-area diagrams are not conducive to making such an estimate.

137 pages. \$1.71. Mic 56-480

ENGINEERING, ELECTRICAL

TRANSIENT RESPONSE OF INDUCTION GENERATORS

(Publication No. 15,188)

Lewellyn Threewitts Boatwright, Jr., Ph.D.
University of Illinois, 1955

Induction generators have been utilized many years for specialized and limited applications in the electrical industry. Compared with synchronous generators, very few detailed mathematical analyses of this machine have been published. In most instances the literature deals with steady state conditions and starting performance of a closely related machine, the induction motor.

The dissertation, of which this is an abstract, makes use of Blondel's two-reaction theory to derive differential equations which can be solved by usual methods for the transient or steady-state performance of the induction machine. Blondel's theory was developed originally in order to represent mathematically the salient pole synchronous machine. It has been extended and modified by many authors, such as Doherty and Nickle, Concordia, Cray, Clarke, Park, Prentice, Ku and Stanley, to include many generalized and specialized examples which cover

exceedingly well all aspects of synchronous machines. With this background as a starting point, the dissertation extends further the theory to include the generalized case of a three-phase stator, n -phase rotor induction machine. The principal modifications to Blondel's theory are fixing the reference axes in the stator and mathematical representation of an n -phase rotor.

Certain simplifying assumptions are used, the most important being Park's definition of the "Ideal Machine". Thus, hysteresis and eddy current effects are considered negligible, the machine has full pitch symmetrical windings, there is a linear relationship between magnetic fluxes and currents, the air gap m.m.f. is sinusoidally distributed, skin effect and capacitance between conductors are neglected.

The machine is treated as a multi-mesh, lumped constant, bilateral circuit network with mutual coupling between the stator and rotor a function of their relative positions. This leads to differential equations with variable coefficients which are quite difficult to solve in closed form. Blondel's two-reaction theory is, in effect, a change of variable which eliminates the variable coefficients and simplifies the equations so that they are more amenable to operational solutions. This is introduced and extended to the generalized n -phase rotor, the final result being a set of linear differential equations with constant coefficients which specify completely the machine performance. Among the coefficients is a speed term which may be considered constant only if the inertia of rotating members is sufficient to insure no change in speed during the entire interval of interest. Alternately a piecewise solution of the equations may be necessary, depending upon the type of machine and conditions imposed. Other non-linear factors, such as saturation effects, can be introduced and solved in a similar manner.

The theory as developed may be used as a guide for further investigation into special cases. For example, the simplifying assumptions could be modified to include non-linear lumped circuit elements, or rotors with mechanical time constants of the same order of magnitude as the electrical time constant might be considered.

50 pages. \$1.00. Mic 56-481

TOPOLOGICAL REALISATION OF DRIVING POINT ADMITTANCE FUNCTIONS

(Publication No. 15,265)

Sundaram Seshu, Ph.D.
University of Illinois, 1955

This thesis presents the algebraic topological considerations pertaining to the design of driving point functions as contrasted with the usual discussions of network synthesis which concern themselves with the analytic character of the network functions and their decompositions.

Abstractly a lumped network may be represented as a linear graph with certain "weights" attached to the elements of the graph. In the present discussion the weights are admittances of basic network elements - resistor, inductor and capacitor - which are defined as elementary positive real functions. In the absence of magnetic

coupling, the network functions are expressible simply in terms of the topology of this weighted graph. The product of the admittances of the branches of a tree is defined as a tree product. Then the driving point admittance at a pair of vertices 1 and 2 is $V(Y)/W(Y)$ where $V(Y)$ is the sum of the tree products for the original graph and $W(Y)$ is a similar sum for a graph obtained by identifying the vertices 1 and 2. Conversely if the driving point admittance is expressed as a ratio of two homogeneous polynomials, as $V(Y)/W(Y)$ where the variables are elementary positive real functions, it must be possible to construct the graph. The properties of the polynomials V and W with regard to their realisability are the central results of the thesis. The circuit matrices of the graph and the graph obtained by identifying the input vertices are derived from the polynomials V and W . The two matrices are very closely related for realisable polynomials V and W . The vertex matrix of the graph is derived from the circuit matrix. The graph, of course, can be drawn immediately.

An alternative approach to the problem is also presented. Here the weighted graph is considered as a switching circuit. The switching function of the circuit is deducible from the ratio $V(Y)/W(Y)$ and thus it is possible to reduce the network problem to a switching problem. The switching function obtained is a single contact frontal switching function.

An algebraic generalisation of Brune's theorem that "a positive real function of a positive real function is positive real" is given. A sufficient condition for a matrix of integers mod. 2 to be a circuit matrix is another auxiliary result obtained.

Several unsolved problems are stated. The most important of these is to devise a method of choosing the elementary positive real functions and the polynomials V and W with the assurance that they will be realisable. The solution to this problem would lead to a practical synthesis procedure when coupled with the present investigation. At present the value of the thesis is primarily academic—in providing results which are useful in a discussion of basic ideas and in suggesting problems in the rich and unexplored field of topological methods of network synthesis.

53 pages. \$1.00. Mic 56-482

ENGINEERING, MECHANICAL

AN APPROXIMATE METHOD FOR CALCULATING THE HEAT TRANSFER THROUGH A TURBULENT BOUNDARY LAYER SUBJECTED TO STREAMWISE GRADIENTS OF VELOCITY AND PRESSURE

(Publication No. 15,166)

Paul Nichols Stevens, Ph.D.
Northwestern University, 1955

A method is presented for predicting the local heat transfer coefficients for a turbulent boundary layer subjected to streamwise velocity and pressure gradients. The predicted values were in acceptable agreement with measured values obtained at this laboratory and elsewhere. Several attempts have been made to solve the general problem by solutions satisfying a number of fundamental

relationships: the integral momentum equation, the energy equation and the continuity equation. Unfortunately, solutions of this kind require assumptions to be made on the velocity and temperature profiles as well as approximations on the skin friction and the relationship between heat and momentum transfer. The methods, while rigorous in structure, lead to equations which do not lend themselves to easy mathematical manipulation.

The analysis is based upon the empirical flat plate equations for local heat transfer coefficients without pressure gradient, and on a stepwise solution of the von Kármán momentum equation. One dimensional flow conditions are assumed to exist outside of a fictitious laminar layer (to be defined later). The empirical flat plate equation, although not applying directly to the more complex case, offers a means for avoiding many mathematical obstacles. In other words, such an equation contains within itself the relationship between the real velocity and temperature distributions, and the effects of the real laminar sublayer and buffer layer are therefore inherently included. Special treatment will be required if thermal and hydrodynamic boundary layers are not initiated at the same point. Problems with or without an initial boundary thickness at the entrance can be solved with equal ease as long as it is reasonable to assume that the thermal and hydrodynamic boundary layers originate together.

ANALYSIS

1. The flat plate equation is extended to include the case of turbulent flow with variable main stream velocity.
2. The following fictitious flow model is assumed to determine the effect of the actual pressure gradient on the local heat transfer coefficient. A laminar layer is defined by

$$\delta' = \frac{k}{h'} \quad (1)$$

(where h' is determined from step 1). The velocity distribution for this layer is assumed to be

$$u = ay + cy^3 \quad \text{If } u = U \text{ and } \frac{\partial u}{\partial y} = 0 \text{ at } y = \delta'$$

$$u = 0 \text{ at } y = 0$$

$$u/U = 3/2 (y/\delta') - 1/2 (y/\delta')^3 \quad (2)$$

3. The von Kármán momentum equation is stepwise integrated to find the pseudo-pressure gradient required to satisfy momentum considerations for the fictitious layer.
4. The real pressure gradient is now superimposed on the pseudo-gradient and the von Kármán equation again integrated to obtain a corrected fictitious laminar thickness δ'' (corrected for the effects of the real pressure gradient).
5. The corrected coefficient is then equal to

$$h'' = \frac{k}{\delta''} \quad (3)$$

The fictitious layer δ' is not intended to describe in any way the real turbulent boundary layer. Obviously, its thickness will be much greater than that of the real laminar sublayer but considerably less than that of the buffer layer. The cubic parabola arbitrarily selected for the velocity distribution follows usual practice for a laminar

boundary layer but, in all probability, this distribution is not compatible from momentum considerations with the fictitious layer thickness δ' . Since δ' has been defined to be proportional to the heat transfer coefficient, any change in this thickness as influenced by the real pressure gradient will directly influence the coefficient. The pseudo-pressure gradient dp^0/dx balances the momentum equation and thus removes the necessity of more careful selection of the velocity distribution, and also adjusts for the absence of a buffer layer. But this pseudo-gradient does not reflect any part of the real pressure gradient since it is a defined modifier for the flat plate coefficients; these coefficients, as extended, do not contain the effects of any pressure gradient.

The method of calculation was directed primarily at heat transfer through a turbulent boundary layer although it is believed that the method will apply equally well for laminar boundary layers and it may even yield additional boundary layer information. Note that the fictitious laminar layer for the turbulent case bears no resemblance to the real situation while, for the laminar case, the thickness δ' should be quite compatible to the real layer.

102 pages. \$1.28. Mic 56-483

ENGINEERING MECHANICS

PREDICTION OF THE RHEOLOGICAL BEHAVIOR OF CONCRETE FROM ITS SONIC PROPERTIES

(Publication No. 15,191)

Tien-Sun Chang, Ph.D.
University of Illinois, 1955

The purpose of this investigation is to relate the properties that can be obtained from sonic testing to the creep and relaxation behaviors of concrete in compression and in flexure.

A generalized theory which describes the rheological behavior of any visco-elastic material under load or straining was developed in terms of tensor notations. Theories of rheological or mechanical models which may be linear or non-linear were discussed, considered and analyzed. Their possible applications to the behaviors of concrete under sustained loading or straining were also carefully studied.

Five experimental investigations were made. Cylinders, 6 by 12 in., were sonic-tested, creep loaded, or constantly strained. Five beams, 4 by 6 by 100 in., were loaded under their own weight while simply supported. Two beams, 6 by 6 by 64 in., were loaded at third points while simply supported. All long-time tests except the relaxation tests were carried out in constant temperature and humidity.

Valid mechanical models were selected to represent concrete in creep and relaxation and their coefficients were statistically related to the sonic properties.

A simple procedure was developed to relate the creep curve of one concrete beam to another if they were made of the same concrete.

From this investigation the following conclusions are reached:

1. It can be said that the sonic properties of concrete are closely related to the other rheological behaviors of concrete.

2. The visco-elastic representation of concrete in terms of the rheological models is non-linear in nature.

3. There are two ways to describe the creep behavior of concrete under sustained axial compressive stresses by means of a non-linear rheological model. The first way is by use of a non-linear Kelvin's solid with a strain-softening spring and a time-thickening dashpot. The other way is by use of a non-linear Maxwell's liquid with a stress-softening spring and a time-thickening dashpot. The disadvantage of the non-linear Kelvin's solid is that this model will not describe the relaxation of stress behavior of concrete at all. The non-linear Maxwell's liquid, however, does describe both behaviors adequately.

4. The behavior of concrete under sustained flexural loading was found to be much more complicated than the behavior of concrete under sustained axial compression. This is due to, (1) the strain gradient on the specimen, and (2) the unequal creep of concrete in tension and in compression. The second case introduces further non-linearity to the creep behavior of concrete and as a result causes the shifting of the neutral axis of the flexure specimen and gives a faster rate of creep for concrete flexure specimens.

5. For a cylinder loaded to less than 50 percent of its ultimate strength, the creep of the cylinder can be considered as proportional to the percentage of sustained stress on the cylinder. 223 pages. \$2.79. Mic 56-484

ENGINEERING, METALLURGY

A PORTION OF THE NICKEL ALUMINUM EQUILIBRIUM DIAGRAM

(Publication No. 15,412)

Robert George Ulrech, Ph.D.
Purdue University, 1950

Major Professor: J. L. Bray

The binary nickel-aluminum equilibrium diagram from 80-100% nickel was reinvestigated using the classical methods of thermal analysis and microscopic examination. A eutectic system was found to exist in this region of the diagram with limited solid solubility at each of the terminal points. The limits of the eutectic arrest extend from 82.5% - 88.5% nickel at the eutectic temperature of 1365°C. Results of this investigation only partially confirmed the existing data concerning this portion of the diagram.

Nickel-aluminum alloys containing from 5-10% aluminum are susceptible to precipitation hardening treatments but require extremely long solution periods.

98 pages. \$1.23. Mic 56-485

THE ENERGY STORED IN INGOT IRON
DEFORMED BY TORSION
AT 25°C, -82°C & -185°C

(Publication No. 13,441)

Teh Po Wang, Ph.D.
University of Pennsylvania, 1955

Supervisor: Norman Brown

An experimental apparatus was constructed for the measurement of temperature difference during annealing of a cold worked and an annealed metal specimen from which the energy stored in the cold worked one can be calculated. Stored energy of 0.3 to 1.1 cal./gm. was found for Armco ingot iron specimens deformed in torsion to different strains at room temperature, dry ice and liquid air temperatures. Stored energy was found to release in two stages. Recovery contributes to the initial stage of energy release. The release of the major portion of the stored energy is concurrent with recrystallization.

82 pages. \$1.03. Mic 56-486

ENGINEERING, SANITARY AND MUNICIPAL

THE EFFECT OF SYNTHETIC
DETERGENTS UPON RAPID SAND
FILTER PERFORMANCE

(Publication No. 15,532)

Lawrence Harry Sanford, Ph.D.
Cornell University, 1955

This study has been confined to the alkyl benzene sulfonates, the detergent type most likely to be found in water courses due to their large tonnage production and their slow degradation.

Theoretical considerations indicate that detergents may affect filter operation in two ways: 1) adsorption of the detergent molecule and possible subsequent fixation to the filter media surface affecting the contact angle in such a manner as to increase the head losses across the filters (air binding); and 2) adsorption of the detergent molecule to either the floc surface or the sand surface appreciably altering zeta potential and the degree of hydration. The latter condition will be significant only if an appreciable percent of the particles to be removed are less than 10 μ in diameter. Consequently preliminary work was necessary on the nature of the filter influent.

The major portion of the experimental work consisted of passing an alum coagulated synthetic water of known hardness alkalinity and bacterial count through parallel experimental and control filters. Fresh sand was used for each filter run so that the chemical and physical identity of the filter surfaces was known at the beginning of each run. The control filter in every case was a medium filter sand comprised mainly of quartz. Experi-

mental filters included: 1) stearate coated sand (Quilon); and 2) normal filters to which various amounts of alkyl benzene sulfonates were added to the influent.

The property Head loss vs. Rate of Flow was considered to be a compound measure of particle size and distribution, stratification, and porosity of the filter in place. Reasonable agreement of this property for the two filters was a requirement before beginning each run.

Bacterial and aluminum concentrations were measured in filter influents and effluents as were head losses across the filters.

The following conclusions were drawn:

1. The standard plate count procedure gives an accurate measurement of the total number of cells in a flocculated suspension, providing the sample is shaken vigorously immediately prior to plating.
2. In conventional alum flocculation bacterial cells may be found at all depths of the floc particle, indicating that they are adsorbed or mutually coagulated when the floc is still 5 μ in diameter or less.
3. There is no significant difference in the effluent quality in either the bacterial or aluminum residual as a result of a stearate (Quilon) coating of the sand surface.
4. There is an increase in head loss accumulation during the filter run as a result of the Quilon coating which theoretical considerations and experimental evidence suggests is proportional to the degree of gas supersaturation.
5. Concentrations up to 20 ppm alkyl benzene sulfonate applied to the filter influent, give no significant difference in effluent bacterial or aluminum quality.
6. There is an increase in head loss accumulation during filter runs resulting from the presence of 5, 10, and 20 ppm of alkyl benzene sulfonate. The mechanism is not known but contrary to the theoretical considerations developed, it does not appear to be the result of increasing airbinding.
7. There is no appreciable change in low contact angles (\bar{Z} 30°) resulting from alkyl benzene sulfonate concentrations up to 50 ppm; at high contact angles (90°) a reduction was apparent at 20 ppm.
8. Surface forces between the sand surfaces and the alum floc, and bacterial surfaces coagulated by alum, are insignificant as a removal mechanism.
9. The effect of a stearate coating on the sand surfaces and of 5, 10, and 20 ppm of alkyl benzene sulfonate added to the filter influents is primarily one of increased cost of plant operation and under these experimental conditions does not constitute a public health problem.

201 pages. \$2.51. Mic 56-487

FINE ARTS

HORATIO AND RICHARD GREENOUGH: A CRITICAL STUDY WITH A CATALOGUE OF THEIR SCULPTURE

(Publication No. 14,453)

Thomas Brendle Brumbaugh, Ph.D.
The Ohio State University, 1955

Horatio and Richard Greenough have been given little critical attention in their role as leading sculptors of a nineteenth century America rapidly growing to artistic self-consciousness. Perhaps a final analysis of their work will place them among the second- or third-rate artists of their time, yet they exerted a considerable influence on the direction of American official taste toward neoclassic and monumental forms. It is not surprising, therefore, that Horatio Greenough's masterpiece, the colossal "Washington" based on Quatremère de Quincy's reconstruction of the Phidian Zeus, is in Washington, D.C. Now situated among the nation's relics in the Smithsonian Institution, it is a worthy symbol and source of a still developing American aesthetic based on ideals of pragmatic simplicity and classic functionality.

An evaluation of the Greenoughs' sculpture required, first of all, the discovery of its whereabouts. Much of their work has been "lost" in private and even public collections. Secondly, the making of a catalogue and chronology further helped in studying their artistic contribution. It becomes clear that Horatio Greenough (1805-1853) in his best work was closer to realization of his aesthetic ideals than is usually recognized. His early bust of Josiah Quincy (1826) is a monumental ancestor portrait. Thomas Cole's bust (1831) is, by contrast, sensitive and appealing in its understatement. "David Sears' Children" (1834), marred like many of the works by classic "furniture," achieves something of the dignity and heroic impressiveness of the "Washington" (1841). Influenced by the styles of many artists, from the rococo of Canova to the mechanical naturalism of Hiram Powers, Greenough maintained his integrity, if seldom his individuality, in works like the Donatelloesque "Angel Warning St. John" (1838) and the Hellenistic "The Rescue" (1837). Deluded by historic styles, he never found a satisfactory means by which to express fully the poetic insights we sometimes find in his art. He used style as a way of doing rather than as a way of thinking, and left behind him a vast corpus of work which, except for a possible dozen fine pieces, fails to rise above being a curiosity in the history of taste.

After the older brother's death, Richard Greenough (1819-1904) carried on his work with slight variations during the remaining half-century. A conscientious craftsman, he barely missed being an "iron photographer" like W. W. Story. His "Franklin" (1856) is a competent but uninspired document. Richard, unlike Horatio, compromised in most artistic matters, and he seems to be a passive and confused old man in his art. Often he vacillated between the grotesque monumentality of a

"Magdalene" (1869) and the figurine-like scale of "Circe" (1882). A sculptor by virtue of technique alone, his lack of genius would be nearly fatal to his reputation had he not, like Horatio, a permanent place in the history of art as one of the first Americans who saw himself as a professional artist. No doubt both of the Greenoughs were completely a part of their eclectic period, as well as of a long and inhibiting sculpture tradition; they made what seems to be a senseless creative detour through an exhausted classical rhetoric. Yet it led in the twentieth century to the making of works of art which they had anticipated, where "form follows function" and casts off its Greco-Roman skin to become classic in the best sense. From their significant and influential position, the Greenoughs helped teach their countrymen that beauty grows out of an expression of the noblest ideas by the most economical means. 302 pages. \$3.78. Mic 56-488

CEREMONIAL AND ART AT THE Umayyad COURT

(Publication No. 13,694)

Oleg Grabar, Ph.D.
Princeton University, 1955

This dissertation examines the problem of the way of life of the Umayyad caliphs by studying together literary sources and works of art.

The literary sources permit a sketch of the main features of Umayyad court ceremonial. First, in the Umayyad period a fairly developed ceremonial of receptions and audiences evolved which emphasizes the separation of the prince from his subjects through the formation of a body of court officials and through the spatial relationship between prince and audience. The complexity of ceremonial life is further indicated by the existence of two types of throne. A differentiation between the king as *imām* and the king as *amir* accords with the political thinking of early Islam which distinguishes prophetic from royal authority.

Second, drinking, dancing, listening to music and poetry, while surrounded by slave-girls, were not simple pastimes, but expressed the royal character of the caliph's life. Neither the separation of ruler and subject nor the ceremonial pastime, the two essential features of Umayyad ceremonial life, can be traced to an Arabian background. While the separation between ruler and subject effected through spatial setting, dress, throne, and so on, is common to Romano-Byzantine and Sasanian practices, the idea of the ceremonial pastime is related to oriental traditions, just as the major ceremonial function of the Umayyad ruler—to appear rather than to act—is closer to the *shāhinshāh* than to the *basileus*.

Umayyad architecture reflects the growth of royal ideas and royal ceremonial. The problem of integrating a mosque and bath with a palace is foremost in explaining the development of architectural plans. The two features of the palace which are most connected with ceremonial life, the gate and the throne-room, confirm the evidence as to their use by the Umayyad caliphs: we have a fairly simple gate and a developed throne-room. The origins of these features must be sought largely in the Romano-Byzantine tradition, just as the plan of Umayyad palaces, with the probable exception of Mshatta, continues a Roman and Byzantine development of the camp-palace.

The figurative remains from the three palaces of Qusayr 'Amrah (where the main hall only was examined), Khirbat al-Mafjar, and Qasr al-Hayr, although differing in style, show iconographic similarities. Their main theme is the king surrounded by musicians, athletes, dancers, and hunting scenes. With the exception of hunting, practically a universal expression of royal glory, these features can be traced to an oriental tradition appearing not only in Persia but also in Central Asia and India. They also

illustrate the ceremonial aspect of pastime as it is shown in texts. At Qusayr 'Amrah, where the paintings are in situ, two unique scenes remain which are important because, although they are strongly influenced by Sasanian traditions, their iconography is strictly Umayyad, and indicates that the Umayyads were conscious of the meaning of their figurative art.

In the light of these results, the concept of the bādiyah cannot be maintained. Only two Umayyad palaces can be said to be truly in the desert. It would appear rather that the building of numerous castles was, as is apparent in many texts, an expression by the Umayyads of their royal power.

The extent of eastern influences on the art and ceremonial of the Umayyads can be explained by the facts that the whole of Iran with its men and traditions was incorporated into the new empire; and that there was a definite movement of objets d'art from east to west. Thus 'Abbāsid civilization should be considered as a continuation rather than the antithesis of Umayyad civilization.

351 pages. \$4.39. Mic 56-489

FOLKLORE

A MOTIF-INDEX OF POLYNESIAN, MELANESIAN, AND MICRONESIAN NARRATIVES

(Publication No. 14,660)

Bacil Fleming Kirtley, Ph.D.
Indiana University, 1955

In the present dissertation a representative and fairly comprehensive portion of the myths, the tales, and the legends of Polynesia, Melanesia, and Micronesia is analyzed and classified according to the system developed by Professor Stith Thompson and followed by other folklore scholars. An attempt has been made to ascertain the degrees of relationship existing between the total bodies of Polynesian, Melanesian, and Micronesian narrative materials; to explore the affiliations of this area's oral literature with that of regions more thoroughly studied; and to interpret the emphases and preoccupations of these Oceanic cultures which are reflected in oral narratives.

To the main body of the thesis is appended a list of 316 motifs—motifs deemed significant because they are adequately distinctive to suggest genetic relationships between tales in which they are found. Their occurrence is as follows: 62 motifs occur only in Polynesia; 53 occur only in Melanesia; 18 occur only in Micronesia; 41 occur only in Polynesia-Melanesia; 56 occur only in Polynesia-Micronesia; 34 occur only in Micronesia-Melanesia; and

61 occur in Polynesia-Melanesia-Micronesia. If this chart represents an undistorted model, these facts are suggested. A significant number of narrative themes is shared commonly by Polynesia, Melanesia, and Micronesia. Micronesian mythology, as might be expected, is somewhat closer to that of Polynesia than to that of Melanesia. While Eurasian themes appear in each of the three areas, they are most evident in Micronesia, least discernable in Polynesia. Polynesia has received themes from Melanesia; however, they have exported a still larger number to the latter area.

The narratives of Oceania reveal no interest in those themes which are the cultural emanations of abstract ethical systems. That large body of Eurasian material which deals with cleverness and wisdom is, with a very few exceptions, lacking in Polynesia, Melanesia, and Micronesia. Instead, tales of gross trickery—usually treating theft, adultery, murder, or mutilation—embody the fantasies and whimsies of the separate cultures. Nor do the stories of Oceania phrase general reflections about the nature of life and society, as do those of Europe and Asia. Instead, philosophical speculation is focused upon cosmogony and cosmology, which, particularly in Polynesia, is extremely elaborate. The narrative arts of Polynesia, Melanesia, and Micronesia, therefore, are sharply circumscribed by the horizon of the cultures.

688 pages. \$8.60. Mic 56-490

FOOD TECHNOLOGY

THE STABILITY OF THERMAL POLYMERS OF ETHYL LINOLEATE TO AUTOXIDATION

(Publication No. 15,176)

Arnold Eugene Aaland, Ph.D.
University of Illinois, 1955

Pure ethyl linoleate was prepared, thermally polymerized under nitrogen and in sealed glass containers, and the residual monomer and breakdown products were removed by methanol extraction. The insoluble polymer was placed in Petri dishes in a closed tube lighted by two 15 watt daylight fluorescent tubes. It was then autoxidized at room temperature with oxygen at atmospheric pressure. The volatile decomposition products were collected in cold traps packed in solid carbon dioxide. The traps were washed with methanol and this solution was used to determine the concentration of carbonyl compounds colorimetrically, since the carbonyl compounds have been shown to be proportional to the peroxide value, the usual guide to fat oxidation.

The results indicated that the use of High Purity Dry nitrogen produced a greater yield of polymer which was less stable to autoxidation than the polymer formed in evacuated sealed vessels. The nitrogen used was shown to contain oxygen, which may have helped contribute to the instability of the polymer to oxidation by the formation of oxidative polymers along with the thermal polymer. The removal of decomposition products by the nitrogen may have allowed a more complete polymerization as indicated by the larger yield of methanol-insoluble polymer from the ethyl linoleate heated under nitrogen. The carbonyl values of the latter increased rapidly at first but then leveled off. This indicated that the oxygen uptake was no longer proportional to the peroxide value and to the carbonyl absorbance.

Both fractionated polymers were also subjected to depolymerization conditions by refluxing with ethanolic hydrochloric acid. The infrared data of the resultant product indicated that in contrast to oxidative polymers the thermal polymer did not break down. However, the free carboxyl groups were esterified and some of the trans carbon-to-carbon double bonds were isomerized to the cis form. It was also noted that the refractive index decreased, which was expected with the esterification of free carboxyl groups in the polymer.

61 pages. \$1.00. Mic 56-491

THE INFLUENCE OF MILK COAGULATING ENZYMES UPON SOME OF THE CONSTITUENTS AND FLAVOR OF CHEDDAR CHEESE DURING RIPENING

(Publication No. 15,610)

Harold Milton Windlan, Ph.D.
Cornell University, 1955

Five series of Cheddar cheese were made from raw and pasteurized (161°F. - 16 seconds) milk obtained from several sources. Within each series, two levels of rennet and two levels of a rennin-like mold enzyme, proteolytic enzyme X108, were used to coagulate the milk. In addition, in series 10854, two levels of papain were used. Manufacturing procedure and technique were standardized for all conditions except enzyme coagulant. After the cheese was removed from the press, each lot was cut into 12-ounce blocks, wrapped in parchment paper, and sealed in suitable size tin cans under 25 inches of vacuum. The cans of each series were equally divided into two lots and the cheese ripened at 50° and 60°F.

Each cheese was analyzed for fat, moisture, salt, and total protein at 0 days of age. At periods of 0, 30, 60, 90, and 180 days, each cheese at each temperature of ripening was analyzed for tyrosine and tyramine content, free amino acid content, total volatile acidity, and short chain free fatty acids. The pH and flavor development were determined.

The free tyrosine content of the cheese increased in most cases at a rather uniform rate. The conversion of the free tyrosine to free tyramine was retarded and was not significant until the 180 day analysis. The tyramine content of most cheeses exceeded 350 gamma per gram when its flavor was judged as sharp. There were some exceptions. The tyrosine and tyramine concentrations in cheese were influenced by the heat treatment of the milk and the ripening temperature of the cheese.

The free amino acid liberation was remarkably similar (qualitatively) in all cheeses. Most of the cheeses contained 16 free amino acids at the 180 day analysis. The relative concentration of amino acids was determined by measuring the optical density of the chromatographic spot and multiplying this by the area in square inches. Using this figure as concentration, most amino acids were present in higher concentrations in the cheeses ripened at 60°F. regardless of the enzyme coagulant used.

An ionographic - chromatographic technique was developed applicable to the identification of the small-peptide fraction from a complex mixture such as cheese. Peptides containing the amino acids glycine and tyrosine, glycine and tryptophane, tyrosine only, glycine and proline, alanine and tyrosine, and alanine and leucine were isolated.

No peptides containing three different amino acid residues were found.

This was a qualitative technique and, therefore, concentrations of each peptide were not known. Qualitatively there were few differences in the small-peptide fraction from cheese made with proteolytic enzyme X108 or rennet. How these peptides fit into the overall flavor picture of cheese is not known; however, water solutions of alanyl methionine, alanyl phenylalanine, and glycyl tyrosine (4 mg./ml.) were bitter.

The total volatile acidity of the cheese was affected by two conditions: (1) heat treatment of the milk, and (2) ripening temperature. Raw milk cheese developed a greater total volatile acidity than its pasteurized milk counterpart. Cheese ripened at 60°F. developed a greater total volatile acidity than its counterpart ripened at 50°F. Individual short chain fatty acids were determined using a chromatographic method. Acetic acid was present in all the cheeses from 0 days through the 180 day analysis. Butyric, caproic, and caprylic acids were not present be-

fore the 180 day analysis but were all present at this time. Traces of valeric acid may have been present.

The pH of proteolytic enzyme X108 cheese was slightly lower than that of rennet cheese. This difference did not affect the flavor of the cheese.

A bitter fraction was isolated from a casein solution treated with a large excess of proteolytic enzyme X108. Subsequent ionophoresis demonstrated that the fraction contained two polypeptides containing the following amino acids: glutamic, glycine, proline, valine, alanine, and leucine. Seven bitter cheeses, 4 rennet (commercial), 1 proteolytic enzyme X108, and 2 papain, were analyzed. The rennet and proteolytic enzyme X108 cheeses contained similar peptides.

The flavor of the cheese made using proteolytic enzyme X108 was comparable with that of cheese of the same series where rennet was used.

91 pages. \$1.14. Mic 56-492

GEOGRAPHY

AN ANALYSIS OF THE LIVELIHOOD PROBLEMS OF THE TUCSON STANDARD METROPOLITAN AREA

(Publication No. 15,074)

Andrew Wilkins Wilson, D.S.S.
Syracuse University, 1955

The objective of this project was to analyze the livelihood problems of Pima County, the Tucson Standard Metropolitan Area in southern Arizona. This involved a consideration of population patterns, employment, income payments, urban functions, natural resources, and economic institutions; what this area sold to support its economy; and whether the economic support was adequate. Upon finding that the support was somewhat inadequate, directions of desirable change were suggested.

Tucson has a rapidly growing population attracted by climatic and health advantages. Since 1945 population has increased regardless of employment opportunities. Employment declined 10 per cent from December, 1952, to August, 1954, in contrast to a population increase of 14 per cent.

Analysis of employment and income payments for 1952 indicated that the leading source of support was government, Federal and state. Next most important was manufacturing. Less important sources of earned income were agriculture, the transportation-utilities group, and services. Mining was little more important than trade or construction. Property income, representing unearned income, was exceeded only by government and manufacturing in supporting the area. Tucson, once a fortification, now is a multifunctional city located at an important crossroads.

Natural resources of Tucson include its level site; dry, sunny climate with mild winters and long, warm summers; sufficient water for urban growth, if not for agriculture;

copper deposits; grazing lands, although generally poor; and manpower with varied skills.

The outlook for irrigated agriculture and mining is dark, since these are ephemeral industries. Manufacturing is concentrated in two defense facilities with questionable futures. Transportation's supporting contribution is shrinking; public utilities are largely dependent. Tucson's umland in Arizona has little population, limiting growth of supporting trade and services. The finance group is unimportant. Government employment lacks stability in the important defense portion, with decisions made elsewhere. Tourism is highly seasonal, while attraction of the retired has not been pushed. Even the Papago Indians face problems of expanding their supporting employment.

With population outstripping economic supports, and with much of supporting activity unstable, Tucson faces livelihood problems. The people of Tucson can either do nothing, try to strengthen all types of supporting employment, or concentrate on types most likely to yield good results.

Sources of supporting employment and income offering little hope of improvement are agriculture, mining, the transportation group, the finance group, and government, because it is unpredictable. Offering some hope of improvement are trade and services through exploitation of the expanding economies of Sonora and Sinaloa, tourism through exploitation of the West Coast of Mexico highway.

However, the sources offering most hope of expanding support are retired persons and manufacturing. The retired tap proliferating sources of property income, and they may be attracted by preparing facilities for them. Unlike tourism, this is not seasonal business and Tucson's isolation is less of a handicap.

An even more important prospect is increased and diversified industry. Some footloose industries can find a good labor pool in Tucson, while the aviation,

electronics, and cotton textile industries can find additional advantages. Aviation should benefit from climate; electronics from propinquity to the armed forces electronics testing facility at Ft. Huachuca. Cotton textile mills can use profitably the fine, local cotton.

This program will require adequate water supply for urban growth, and contraction in irrigation use. This involves a more efficient use of this key resource, supporting more persons per acre foot of water.

So far, Tucson has made some effort to attract industry, but it is up to the leaders and the people of the area to decide if a more effective effort will be made to solve the livelihood problems facing them.

503 pages. \$6.29. Mic 56-493

**THE IMPACT OF RESIDENTIAL
GROWTH ON LAND USE IN A
SUBURB, 1930 TO 1950,
WINCHESTER, MASSACHUSETTS**

(Publication No. 15,170)

William Adriance Withington, Ph.D.
Northwestern University, 1955

The rapid growth of suburbs has been a significant fact in the development of the United States in recent decades. As a part of this rapid growth there have been numerous residential developments, large-scale movements of people, and major changes in land use.

This study has two objectives. The first objective is to examine three problems: (1) the character of suburban residential growth; (2) the character of movements of people associated with residential growth; and (3) the impact of suburban residential growth on land use within a single suburb, Winchester, Massachusetts. The second objective is to establish tentative hypotheses concerning the impact of residential growth on suburbs which may be tested in subsequent studies.

Winchester, Massachusetts, is a residential suburb of nearly 16,000 people, located in a middle ring of suburbs around Boston, eight miles northwest of its center. Winchester's territory encompasses a densely settled lowland rising in a valley slope to an upland on the east and to a hilly area on the west. In both areas the slopes are largely occupied by residences; the uplands by woodland or agricultural land.

Between 1930 and 1950, 1,119 new dwelling units were built in Winchester. This equalled one-third of the total in existence in 1930. Residential growth was predominantly in peripheral areas of the suburb on land either in farms, forests, or large estates. Residential growth near the center of the suburb intensified the dwelling densities of

older residential areas by filling in unoccupied plots of land. Except for forty-eight units, new residences were all single-family dwellings.

A total of 13,832 people over twenty years of age moved into Winchester between 1930 and 1950; more than two-thirds of them from the Standard Metropolitan Area of Boston. Most in-migrants moved into new residential areas in peripheral parts of the suburb. These same areas of greatest residential growth were also the ones with the largest out-movements of people. Intra-movements of people within the suburb totalled 11,715. Most intra-migrants moved between older residences in long-established dwelling areas.

The impact of residential growth resulted in major changes in all types of land use. In transportation land use many local streets were laid out to serve the new residential areas, private automobile and truck use increased greatly on major highways, while railroad freight services were used less. Commercial land use declined in residential areas, but expanded in major areas zoned for business as many commercial enterprises changed from local to branch store control. Changes in industrial land use resulted in a greater concentration of industries in northern Winchester, predominantly of the light industry type not obnoxious to nearby residential areas. Institutional and recreational land use increased with new major facilities near the center of the suburb, and with new elementary schools or playgrounds in dwelling areas providing a greater number and variety of services to residents. Agricultural and forest lands declined in areas as new residential areas expanded in the suburb.

Tentative hypotheses suggested as being applicable to residential suburbs generally similar to Winchester are: (1) residential growth is most rapid in peripheral areas of suburbs; (2) detached single-family residences are the most characteristic type of suburban residential growth; (3) residential land use near the centers of suburbs is intensified by slow growth through construction of single and multi-family dwellings on previously unoccupied land; (4) greatest in and out-movements of people take place in peripheral areas of most rapid residential development in suburbs; (5) intra-movements of people are greatest in central areas of slow growth and high density residential land use; (6) although most people move short distances, increasing numbers move long distances between residences; (7) residential growth and development of automobile, bus, and truck transportation facilities are closely associated; (8) obnoxious and heavy industries give way to less obnoxious and lighter types of industry, particularly when public opinion decides to limit land use by zoning ordinances; (9) branch stores tend to replace locally owned stores; and (10) institutional and recreational land uses in central areas of suburbs tend to serve the whole community whereas those in peripheral areas tend to serve nearby areas of residential growth.

183 pages. \$2.29. Mic 56-494

GEOLOGY

THE ECOLOGY OF THE RECENT OSTRACODS OF THE TODOS SANTOS BAY REGION, BAJA CALIFORNIA, MEXICO

(Publication No. 15,185)

Richard Hall Benson, Ph.D.
University of Illinois, 1955

Forty-eight Recent ostracod species of 30 genera belonging to 6 principal biofacies were collected from an estuary, a salt-water lagoon, and a large open bay on the west coast of Baja California, 60 miles south of San Diego. These include a brackish-water biofacies, a salt-water lagoon and salt-marsh biofacies, and an open-bay mega-biofacies with four biofacies and a subfacies which are dependent on depth, vegetation, and substratum.

Three hundred and sixteen samples of the top 1 cm. of sediment from 170 stations were examined for living and dead ostracods. Depth ranges from supratidal to 215 fathoms in Todos Santos Bay, salinity from 0.5 o/oo in the Rio San Miguel estuary to 37 o/oo in the salt-water lagoon of the Estero do Punta Banda, and temperature from 50° F. in the deeper parts of the bay to 85° F. in the estero. The substratum consisted of rock, cobbles, coarse to fine sand to poorly sorted very fine silt and clay with the finer sediments predominant. The vegetation consisted primarily of eel grass, coralline algae, *Laminaria*, and *Macrocystis*.

Twenty-four ostracod species of 16 genera show sufficient ecologic restriction and stratigraphic range to be used as biofacies indicators in ancient sediments, with some ranging back to the Pliocene. Salinity and depth of water are the two factors that seem most to affect the distribution of the ostracod species in the areas studied. The distribution of structural types of plants greatly influences the distribution of phytal ostracods. Many forms reflect in their carapace morphology their like mode as phytal, endopsammon, epipsammon, epipelos, or endopelos. The distribution of certain sediment types of the substratum could be correlated with the abundance as well as the character of some biofacies.

229 pages. \$2.86. Mic 56-495

RELATION OF PETROLOGY AND STRUCTURE TO PRODUCTIVITY IN A STRATIGRAPHIC TRAP, LINDEMANN (McMILLAN SAND) OIL FIELD, RUNNELS COUNTY, TEXAS

(Publication No. 15,358)

Morton Katz Blaustein, Ph.D.
Stanford University, 1955

The Lindemann (McMillan Sand) Oil Field, Runnels County, Texas, is located on the Eastern Platform of the Midland Basin. It contains two separate reservoirs. The

Lower McMillan sandstone produces from a small structural trap with minor stratigraphic trap-making elements. The Upper McMillan sandstone produces from a combination structural-stratigraphic trap, with stratigraphic conditions being predominant.

Oil fields of this type are difficult to find, as most geological and geophysical exploratory methods are adapted to locating structural conditions which are commonly absent in stratigraphic accumulations. Stratigraphic traps, however, have produced vast quantities of oil and a proper understanding of them is essential to the future of petroleum geology. The present study explores the possibility of determining the nature of oil accumulation in such a field by combining a detailed quantitative petrologic analysis of the reservoir rock with subsurface structural mapping.

The study is based on 309 thin sections from 43 wells. Approximately one-half of these thin sections are from five cored wells, the remainder being from drilling samples in wells which were not cored. The relative quality of these two types of thin sections is analyzed in detail and it is concluded that, in general, both types of material give excellent usable data.

To the author's knowledge, detailed petrologic work has not previously been done with thin sections made from drilling samples. In studying thin sections of this type, it is necessary to guard against the problems of grain spreading and contamination of the samples. It is believed that these problems are successfully met in the present work.

Thin sections of the reservoir rock quite accurately reflect the productive potentialities of the unit. The sandstone, which includes a conglomeratic facies, is generally fine-grained to very fine-grained, and well sorted; the principal cements are calcite, quartz, and clay. Porosities and permeabilities are favorable for fluid transmissibility.

The principal trap-making elements in the Lindemann (McMillan Sand) Field are:

- 1) The updip pinchout of the reservoir rock.
- 2) Structural closure against this pinchout, caused by compaction of the reservoir rock and the underlying shales over a limestone reef.
- 3) Stratigraphic variations in the reservoir, petrologic in nature, which locally determine the productive and barren portions of the field area.

The petrologic parameters which act as trap-making elements are 1) porosity (which is determined by a summation of the following factors), 2) grain size, 3) grain size sorting, 4) calcareous cement, and 5) clay cement. These parameters can be studied in thin section, reduced to quantitative data, and mapped. The maps explain the reservoir conditions and productivity of the Upper McMillan sandstone.

Both the Upper and Lower McMillan sandstone reservoirs offer excellent opportunities for production of additional oil reserves, beyond primary recoveries, through pressure maintenance by water flooding.

A retroactive analysis of the field, from the date of discovery, indicates that if the petrologic study had been made during the development of the field, it would have proved helpful in indicating directions in which to drill and in avoiding dry holes.

The author believes that if the method employed in this study is extended to the analysis of other fields and to dry hole failures between fields, it will eventually be possible to combine sufficient regional information to be useful in the effort to detect regional stratigraphic trends. Such new trends might point to favorable areas for exploratory drilling.

215 pages. \$2.69. Mic 56-496

**PETROLOGY AND STRUCTURE OF
THE MCDAME ULTRAMAFIC BELT,
BRITISH COLUMBIA**

(Publication No. 15,627)

Hubert Gabrielse, Ph.D.
Columbia University, 1955

The southwestern part of the McDame map-area in northern British Columbia is underlain by pre-late Devonian miogeosynclinal rocks and post-middle Devonian eugeosynclinal rocks. Ultramafic bodies, possibly of Mississippian age, are intrusive in the eugeosynclinal assemblage and are in turn intruded by granitic rocks of the Cassiar batholith.

Varying degrees of saussuritization of greenstones are attributed to metamorphism by the Cassiar batholith and to alteration accompanying emplacement of the greenstones. Gneissic greenstones appear to reflect the dynamic effect of intrusive ultramafic bodies.

Ultramafic bodies were probably intruded in a largely crystalline state and banding in these rocks is compared to that observed in salt domes. Minor banding has resulted from metamorphism along joint planes.

Serpentinization of the ultramafic rocks has been widespread and water for this process appears to have been derived from sources outside the bodies. The process of serpentinization and products derived in the field are compared to the products obtained in the experimental system $\text{MgO-SiO}_2\text{-H}_2\text{O}$. The field evidence can be reconciled with a concept of an open system. Classic equations for serpentinization are questioned in the light of field data and a reaction is proposed which assumes that the number of SiO_4 tetrahedra remains constant.

Regeneration of olivine from recrystallized serpentinite has taken place near the Cassiar batholith. Other types of alteration of ultramafic rocks are attributed to hydrothermal activity postdating emplacement of the rocks.

The results of a study of serpentinites are given. Emphasis is placed on the distribution of serpentine minerals in serpentinites.

Chrysotile asbestos veins are thought to have formed in fractures initiated during folding of the rocks. They are believed to be contemporaneous with the folding. The veins

are largely the result of fracture filling by material which has diffused through serpentinite into areas of relatively low rock pressure.

Structures in the McDame ultramafic belt may be largely reconciled with forces and movements associated with the folding of the major synclinorium.

141 pages. \$1.76. Mic 56-497

**THE PETROLOGY OF SOME ARCHEAN
ROCKS FROM THE KRAGERØ DISTRICT
OF SOUTH NORWAY**

(Publication No. 12,810)

Robert Coltart Reynolds, Jr., Ph.D.
Washington University, 1955

Chairman: Arman F. Frederickson

A detailed petrographic examination was made of three diamond drill cores from the Valeberg Peninsula of southern Norway. These drill cores were obtained by Dr. A. F. Frederickson in 1950 while he was studying in Norway on a Fulbright Research Professorship.

The major portion of each of the three cores was composed of coronite-gabbro (hyperite). The hyperites are typical fine-grained gabbros. The average grain size is 1.0 mm although the elongate laths of plagioclase ($\text{Ab}_{45}\text{An}_{55}$; labradorite) may be as long as 3.0 mm. The plagioclase is purple-brown in hand specimen. The labradorite laths are arranged in a typical ophitic pattern and are penetrated, in part, by euhedral to subhedral olivine (hyalosiderite) individuals. Diallage ($\text{Wo}_{40}\text{Fs}_{14}\text{En}_{46}$) and iron ore (titanomagnetite) make up a distinct mesostasis. Every hyperite studied, without exception, has well-developed reaction coronas about all iron-bearing minerals. The olivine is always surrounded by a double corona, the innermost being lamellar orthopyroxene (bronzite) and the outermost consisting of a symplectite (intimate intergrowth) of hornblende (hastingsite) and spinel (pleonaste). The diallage has been altered to hastingsite along grain boundaries, cleavages, and fissures. The iron ore is always surrounded by a single corona of hastingsite and pleonaste. A step-by-step progression may be seen from fresh olivine-gabbros, with only a trace of reaction-rim structures, to completely altered rocks with no olivine; the altered rocks contain abundant relict structures of the original gabbro. The reactions which have governed the alteration of the hyperites are as follows:

Olivine -----> Bronzite
Plagioclase -----> Hornblende / Spinel
Diallage -----> Hornblende
Titanomagnetite -----> Hornblende / Spinel

The optical properties of all of these minerals have been determined and a modal analysis was made for each thin-section, therefore it is possible to treat the above reactions exactly. Magnesium, water, and silicon have been added to the system; aluminum, sodium, and calcium have been lost. Because all of the reactions have been initiated and continued at grain boundaries, the suggestion is made here that the movement of material took place by

diffusion through the water film that covered each mineral grain. The large-scale movement of material to the rock mass is believed to have taken place through fissures and other megascopic discontinuities.

Many of the hyperites have been altered beyond the point at which olivine disappeared. In these rocks, scapolite has formed from plagioclase and garnet has formed from symplectite. It is not possible to treat the garnet and scapolite reactions with a high degree of precision. Nevertheless, both the appearance of scapolite and of garnet constitutes a phase boundary when plotted against degree of alteration and olivine number (amount of olivine in the original rock). The appearance of scapolite and garnet has been governed by the availability of water and dissolved ions as well as the composition of the original rock, and not by variations of temperature and pressure.

In addition to hyperites, other rock types were found in the drill cores. These other rock types are the most abundant in the Kragerø District. One specimen of amphibolite (labradorite-hastingsite gneiss), one gedrite-amphibolite (labradorite-gedrite-hastingsite gneiss), two ødegardites (hastingsite-scapolite gneiss), and two greenschists (clinozoisite-delessite-oligoclase schist) were studied. The author believes that the gedrite-amphibolite, the ødegardites, and the greenschists have developed from normal amphibolites. Magnesium metasomatism has been responsible for the development of the gedrite-amphibolite and greenschists, although the availability of water was different—the greenschists must have formed in zones which were heavily saturated with water. The ødegardites formed from normal amphibolites as a result of introduced water with its dissolved carbon dioxide and chlorine.

A quantitative spectrochemical trace element analysis was made for each portion of the drill cores that was studied in thin-section. Vanadium, strontium, and large amounts of titanium were lost from the system as magnesium was introduced. This titanium may have given rise to the rutile-bearing dikes which have been mined in this region. Nickel and manganese were added to all of the rocks as metamorphism continued.

179 pages. \$2.24. Mic 56-498

THE CRETACEOUS AND TERTIARY CORALS OF NEW ZEALAND

(Publication No. 15,429)

Donald Fleming Squires, Ph.D.
Cornell University, 1955

Although corals have been known from New Zealand waters since 1833, and Tertiary corals since 1850, no

major systematic study has been made since 1880. In that year the Reverend J. E. Tenison-Woods described 27 species of corals from the Tertiary, based on a collection of 96 specimens. This work remained the standard reference on New Zealand fossil corals until the present.

As a result of the current work, 64 species and subspecies belonging to 47 genera and subgenera have been recognized. Twenty-two of these species and two of the genera are described as new. The study was based on the largest collection of New Zealand corals ever assembled—about 1500 specimens. The largest part was loaned by the New Zealand Geological Survey, with smaller lots from other museums and universities in New Zealand.

Six genera of Cretaceous corals have been recognized, the first reported from New Zealand. They have faunal relationships with North and South America, but are predominantly endemic. Paleocene and lower Eocene faunas are poorly known. Those of the middle Eocene are greatly expanded and show affinities with Australia, the Tethys, and the American Mediterranean. By the middle Oligocene the Eocene faunas had reached their greatest diversity, and there was a notable abundance of alcyonarians. Upper Oligocene faunas are reduced because of cooling seas and increasingly sediment-laden waters. The orogenic movements causing regression of the seas culminated in the upper Oligocene, perhaps linking New Zealand to the north with New Caledonia. A great invasion of the North Island by Indo-Pacific corals marks the beginning of the Miocene. The invading fauna is composed of two parts: a number of species of hermatypic corals and an ahermatypic element. The hermatypic corals, abundant in the Kaipara Harbour (Auckland) area did not form reefs and indicate marginal tropical conditions. The ahermatypic forms continued on into the upper Miocene and spread over the whole of New Zealand, and became the dominant element of the Neogene fauna. Steadily decreasing temperatures reduced the number of species until middle Pliocene when the seas began to warm. All the species living at that time are living in the Recent seas.

Sixty-four species and subspecies are dealt with in the systematic section. All are described and figured. Comparison with related species is made, and distribution of fossil and Recent species noted. Five species of Alcyonaria and one hydrozoan are described. The remainder of the species are Scleractinia. Two new genera of the latter are described and two previously described genera which have been poorly known are redescribed, one as a synonym, the second as a valid genus.

269 pages. \$3.36. Mic 56-499

HEALTH SCIENCES, PATHOLOGY

SODIUM SALT POISONING IN SWINE

(Publication No. 15,621)

David Lawrence Thomson Smith, Ph.D.
Cornell University, 1955

For more than one hundred years "salt poisoning" in swine has been an enigma. Many accounts of a clinical syndrome associated with the inclusion of brine, salted fish meal or excess sodium chloride in the diet of pigs either accidentally or through ignorance have appeared in the literature. In spite of this apparent relationship of cause and effect numerous attempts to produce experimentally the characteristic clinical picture by feeding large amounts of sodium chloride have been unsuccessful. This fact and the observation that the disease was nearly always associated with the feeding of meat or fish brine or salted fish meal led many workers to the conclusion that the condition was caused by organic poisons derived from the decomposition of proteins rather than from any toxic effect of sodium chloride.

In the past salt poisoning in swine has been diagnosed on the basis of the history and the symptoms manifested by the animals. Specific macroscopic or microscopic lesions have not been described. Gastroenteritis was found in some but the stomach and intestines were frequently normal. Chemical analysis of the stomach content usually did not reveal an increased amount of sodium chloride.

The studies constituting the thesis were instituted in the fall of 1951 in an attempt to:

1. produce the salt poisoning syndrome experimentally.
2. characterize its clinical manifestations.
3. study the gross, microscopic and clinical pathology of the disease.
4. determine the pathogenesis.
5. apply the information gained to methods for exact diagnosis, treatment and prevention.

Production of the Disease

The experiments show that the phenomena associated with the feeding of brine or salted fish meal to swine can be produced by adding pure sodium chloride to the regular ration of pigs and giving a limited but variable amount of water. The condition was produced by inclusion of as low as 2.5 per cent sodium chloride in the swill. Single intravenous injections of sodium chloride did not cause the disease. Twenty per cent aqueous solution of sodium chloride given by stomach tube to 4 month old pigs at the rate of 2.2 gm. per kg. body weight caused death and 1.8 gm. per kg. body weight produced epileptiform convulsions with eosinophilic meningo-encephalitis. Sodium propionate

in 4 per cent concentration in the feed caused clinical and pathological manifestations identical to those seen in sodium chloride poisoning. Water intake of the pigs was carefully regulated in all successful experiments.

Symptoms

In pigs fed a high concentration of sodium chloride experimentally, the first signs were pruritis, constipation, and thirst. After one to five days of high salt feeding one or more of the pigs became oblivious to any external stimulus. In very acute cases the animal became prostrate and died within 24 hours after the initial signs were observed. Less severely affected animals wandered around aimlessly, bumped into and pushed against objects. Occasionally, the pigs pivoted around on one foot while exhibiting pleurothotonos. Forced circling was commonly seen. Epileptiform seizures were a feature of the condition sometimes occurring with remarkable regularity at 7-minute intervals. The onset of an attack was signaled by twitching of the snout followed in sequence by clonus of the neck muscles, circling or running movements, profuse salivation, and finally contraction of muscles resulting in opisthotonos, respiratory arrest and cyanosis. Frequently, the pigs would propel themselves backwards rapidly giving the appearance of a horse backing a heavy load. Several of the experimental animals turned backward somersaults during this manoeuvre. The pupils of the eyes were dilated and fixed. Occasionally, a pig died during a seizure but usually the fits suddenly ceased and the pig recovered. Pulse, respiration, and temperature were increased as a result of the exertion but rapidly returned to normal. However, in cases produced in hot weather, temperatures to 108 F. were recorded and death from heat-stroke occurred unless preventive measures were instituted.

Lesions

Gross lesions are nonspecific. Ulcers occur in the stomachs of pigs that have experienced many epileptiform attacks.

The results of the experimental studies indicate that the microscopic changes in the brain are pathognomonic. They consist of edema and meningo-encephalitis characterized by infiltration of eosinophils. Peracute cases of salt poisoning show both these alterations to advantage. Encephalomalacia, with proliferation of capillaries and glial cells occur later. The lesions are most prominent in the cerebral cortex, that part of the cortex which forms the walls of the sulci particularly the inner third.

Pathogenesis

The mechanism by which sodium salts produce the clinical and pathological manifestations in pigs has not been determined exactly. The experimental results,

however, generally conform to the hypothesis that a persistent high sodium level in the blood results in accumulation of sodium ions in brain by a process of impeded diffusion. Principally by renal excretion the concentration of sodium and chloride is reduced in the blood stream. A quantity of water given at this time further dilutes the blood. The net result under these conditions could quite conceivably be massive edema of the brain, increased intracranial pressure, reduction of blood supply, and anoxia. Thus the brain tissue is forced to rely largely on anaerobic glycolysis. This process is known to be inhibited by sodium. The more sensitive specialized active regions of the cerebral cortex deprived of a source of energy could be severely damaged under such circumstances.

Diagnosis

Increases in sodium to 50 mEq. per litre and chloride to 30 mEq. per litre were demonstrated in the serums of the experimental pigs. In typical cases, a diagnosis can be made on the basis of clinical signs alone. The clinical picture in enterotoxemia (gut edema) of pigs may resemble acute sodium chloride poisoning. In the latter, however, the animal is unconscious and hence does not respond to stimuli. In the former, a response to stimuli can be elicited and is frequently accentuated. Salt poisoning can be diagnosed on the basis of microscopic changes in the cerebral cortex as indicated above. Chemical analyses of the stomach contents and the feed are not reliable, since sodium chloride is rapidly absorbed from the gastrointestinal tract and the feed may have been poorly mixed.

207 pages. \$2.59. Mic 56-500

HEALTH SCIENCES, PHARMACY

BEHAVIOR OF ACID BASE INDICATORS IN ACETIC ACID SYSTEM

(Publication No. 14,692)

Joseph Aaron Feldman, Ph.D.
The University of Wisconsin, 1955

Acid-base titrations in acetic acid have been developed as standard procedures in the area of pharmaceutical and organic analysis. The titrations have been accomplished by potentiometric and colorimetric means. Since correlations of potentiometric and colorimetric titrations has been often difficult, a study of the behavior of indicators in acetic acid has been undertaken.

The indicators investigated have been acquired from commercial sources or synthesized. They are members of the isocyanine, stilbene, azo, rhodanine, diazo, aniline, triarylcannabinol, and oxazine dyes. Their usefulness extends from the fairly acid to the quite basic acetic acid range.

The present study has been based on the assumption that color of the indicator salts is dependent only upon the degree of proton transfer that has occurred within the ion-pairs of the indicator and not on the degree of dissociation of the indicator substance occurring within

TABLE I

SUMMARIZATION OF THE EQUILIBRIUM CONSTANTS AND APPARENT pK_I 's^π OF SEVERAL INDICATORS AS DETERMINED IN ACETIC ACID SYSTEMS

| | | E HAc E HClO ₄ | NaAc NaClO ₄ | NaAc Na ₂ SO ₄ | A HAc A HClO ₄ | U HAc U HClO ₄ | HClO ₄ |
|--|----------------------|------------------------------|----------------------------|---|------------------------------|------------------------------|-------------------|
| Ethyl Red | K pK _I | 10 5.28 | 45 | 3.7 | 450 | | |
| Pinacyanol | K pK _I | 0.23 4.48 | 1.6 4.43 | | 13. 4.34 | | |
| 4-Dimethylamino-4'-Nitrostilbene | K pK _I | | | | 15 4.32 | | |
| 2-Nitro-9-(4'-dimethylaminobenzal)fluorene | K pK _I | | | | 7.3 4.13 | | |
| 4-Dimethylamino-4'-sulfamylazobenzene | K pK _I | | | | 6.8 4.05 | | |
| Quinaldine Red | K pK _I | 1.5x10 ⁻³ 3.41 | 4x10 ⁻³ 3.51 | | 1.3 3.48 | | |
| 4'-Dimethylamino-benzalrhodanine | K pK _I | | | | 0.39 3.17 | | |
| m-Nitro-N,N,-dimethylaniline | K pK _I | | | | 0.42 3.18 | | |
| Brilliant Cresyl Blue | K pK _I | | | | | 1.6 1.16 | |
| -naphtholbenzein | K pK _I | | | | | 0.96 0.98 | |
| Nile Blue A | K pK _I | | | | | 0.45 0.75 | |
| Sudan III | K pK _I | | | | | | 740 - 1.36 |
| Sudan IV | K pK _I | | | | | | 520 - 1.43 |

E = Ephedrine; A = Antipyrine; U = Urea; Ac = Acetate

^π Expressed as nominal Hammett acidity value

the system. Experimental findings appear to substantiate this assumption.

The behavior of the several indicators in acetic acid was ascertained by a comparison of the interchange reaction constant (K) between the indicator and salt system employed, the apparent pK_I expressed as a nominal Hammett acidity value, and the resulting potentiometric and colorimetric effects of dilution. The resulting K and pK_I values are summarized in Table I. Change in the concentration of the buffer had no apparent effect on the relative composition of the indicator species. Same dilution, on the other hand, produced marked changes in the apparent basicity of the system corresponding to a relative pH change of 1/2 unit for every ten-fold dilution as determined potentiometrically. Thus, equation (I)

$$H_o = pK_I - \log \frac{(BH^+)}{(B)} \quad (I)$$

defining Hammett's acidity function has been shown to be inapplicable in the acetic acid system.

The results discriminate between the potentiometric and colorimetric means of analysis in acetic acid. Color change has been shown to be completely independent of dissociation but it is instead a function of the interchange constant (K) between the salt system and the indicator. Even though the Hammett's acidity function has been shown to be theoretically unsound, it is useful as a means of basicity comparison. On the other hand, the fact that two different indicators may differ in their measurement of the relative basicity of two systems as determined by the interchange reaction constant, emphasizes the limitation of this method in systems of low dielectric constant.

148 pages. \$1.85. Mic 56-501

HEALTH SCIENCES, PUBLIC HEALTH

**A COMMUNITY HEALTH PROGRAM FOR
SHARON, NEW YORK WITH SPECIAL
REFERENCE TO HEALTH SERVICES AND
FACILITIES AND ENVIRONMENTAL SANITATION**

(Publication No. 15,549)

Joseph Kadish, Ed.D.
New York University, 1955

Chairman: Professor Leonard A. Larson

The purpose of this study was to investigate the present status of available health services and facilities and environmental sanitation factors which influence health in Sharon, New York with the purpose of formulating recommendations for a more effective program. Data were collected on (1) the social, economic, and educational factors which operate in the community; (2) the present status of health services and facilities and environmental sanitation; (3) the needs for, knowledge of, and extent of use of health services and facilities; and (4) standards for health services and facilities and environmental sanitation.

The community studied is a rural town located in Schoharie County, the most rural county in New York State; from the combined standpoints of size, rurality, and isolation, it is typical of half the communities in the United States. Unlike other rural health studies, this study has evaluated community health on the basis of a wide range of selected standards. It has considered medical and dental personnel, services, and facilities; school health; and those health programs which are generally regarded as basic for rural health: maternal and child health, communicable disease control, chronic disease control, and environmental sanitation.

Selected volunteer interviewers, trained and supervised by the investigator, procured from heads of households the following data: (1) basic demographic facts, (2) facts of value in estimating the social, economic, and educational status of the community, (3) knowledge of health services and facilities, (4) the health status and health practices of individuals, and (5) home conditions of environmental sanitation. The objectivity of these data was determined by a system of repeat interviews which were performed by the investigator and supplemented by further training of interviewers.

The sample population consisted of 300 households, or approximately two-thirds of the 442 households in the town. A total of 1,013 individuals were included.

The questionnaire used by interviewers included a Medical Needs Schedule, consisting of 27 symptoms designed to determine the extent of needs for medical care among individual adult residents. Instruments used by the investigator in the collection of other data included check lists prepared specifically for this study; the Evaluation Schedule of the American Public Health Association; and documents, official reports, and other primary sources. Direct observation of the school health service program and the school health environment were carried out, the latter with the use of a Sanitary Survey Form, formulated and approved by the New York State Department of Education.

In comparing the present status of health with accepted standards, it was found that the following are among the

major health needs of Sharon and Schoharie County: There is a need in the county for at least five additional physicians, a 50-bed hospital and public health center, and an additional nurse on the staff of the department of health. More pregnant women need prenatal care earlier in their pregnancies. Classes for mothers should be organized throughout the county. Special facilities are needed for the care of premature infants. More infants and preschool children should receive periodic health supervision; a well-child conference should be organized in the county. To achieve a higher level of immunization against communicable diseases, more children in Sharon need to complete immunization courses. Teachers in the central school should become more actively engaged in various health appraisal procedures. The school physician should be required to allow at least ten minutes for each physical examination. The greatest need in environmental sanitation is for more Sharon residents to have their individual water supply and sewage disposal systems inspected.

It is suggested that future rural health surveys consider the county, rather than the town, as the appropriate unit for study. 688 pages. \$8.60. Mic 56-502

**THE DEVELOPMENT OF A PREVENTION
PROGRAM IN A PARATHION MANUFACTURING
PLANT: A STUDY OF THE APPLICATION OF
OCCUPATIONAL HEALTH METHODOLOGIES**

(Publication No. 15,116)

John Ferdinand Osterritter, Ph.D.
University of Pittsburgh, 1955

This is a study of occupational health methodologies. The problem is to evaluate and reorganize the organic phosphate control program of a parathion manufacturing plant, and at the same time to develop a medical program for the entire company.

Plasma cholinesterase values of the exposed plant personnel are statistically analyzed for the purpose of measuring the amount of absorption of organic phosphate by the exposed workmen, and thus indirectly to measure the amount of exposure in the plant. The results of the statistical analysis and the industrial hygiene observations lead to the development of an hypothesis. The hypothesis is that a mixture of the intermediates of parathion have anticholinesterase activity. In vitro, animal and human experiments are performed to test the hypothesis. The intermediates are: ethyl dichlorothiophosphate, diethyl chlorothiophosphate, and triethyl thiophosphate.

As a result of this work a medical program is developed for the company and the organic phosphate control program is evaluated and reorganized. The hypothesis of the anticholinesterase activity of the intermediate mixture is proven at the experimental level to be correct.

The general conclusion is that an organic phosphate control program can be developed and regulated by good industrial hygiene practices. A biological control method, the plasma cholinesterase test, can be satisfactorily utilized, provided that all of the substances with anticholinesterase activity to which the workers are potentially exposed are known. 117 pages. \$1.46. Mic 56-503

EXPERIMENTS WHEREIN EXPERIMENTAL AND CONTROL GROUPS VARY IN TIME AND NUMBER

(Publication No. 15,104)

Theodore Rubin, Ph.D.
University of Pittsburgh, 1955

An experimental procedure wherein different groups of units receive the same treatment at different times is considered. Therefore, as the experiment progresses, there are changes in the number of units receiving treatment and in the number of units in the control group. Definitions of effectiveness of treatment for the experimental procedure under discussion are constructed, estimators for the proposed definitions are developed, and the statistical properties of the estimator are studied.

Three restrictions are placed on the possible definitions. Any definition considered has the properties: (1) the numerical value is zero if treatment has no effect and is positive if treatment is effective; (2) the effects of treatment and the effects of other changes in the environment are separated; and (3) the results of all the different times of starting treatment are utilized in the definition. Two definitions, which fulfill these three restrictions, are

$$(1) \quad \frac{1}{K} \sum_{k=1}^K (U_k - T_k),$$

and

$$(2) \quad \frac{1}{K} \sum_{k=1}^K \frac{U_k - T_k}{t_k}$$

where K is the number of times treatment is started and the number of intervals of the experiment, T_k is the value of the measurement in the population over the duration of treatment for the k th time of starting treatment, U_k is the value of the measurement in the population, if untreated, over the duration of treatment for the k th time of starting treatment, and t_k is the number of intervals of treatment, i.e., the duration of treatment, for the k th time of starting treatment.

Estimators for the definitions can be written in the following form:

$$\sum_{k=1}^K b_k \frac{N}{N-kn} \tilde{u}_k - \sum_{k=1}^K a_k \frac{N}{n} \tilde{T}_k$$

where \tilde{u}_k is the observed value of the measurement in the units not receiving treatment during the k th interval, n is the size of each treatment group, N is the number of units in the universe ($N = (K+1)n$), \tilde{T}_k is the observed value of the measurement over the duration of treatment in the group in which treatment is started at the beginning of the k th interval of the experiment, and a_k and b_k are constants which depend on the definition and, perhaps, on the measurement used.

Groups of size n are drawn at random and without replacement from the universe. The first group drawn is to receive treatment at the beginning of the first interval; the second group is to start to receive treatment at the beginning of the second interval, and so on. The last group remaining does not receive treatment over the course of the experiment.

Under this assignment scheme, it is shown that the estimator is unbiased and the variance of the estimator is obtained.

To find the bias of the estimator, the expectation of the estimator over all possible ways of forming the different treatment groups is determined. The same method is used to determine the variance of the estimator.

The basic assumptions are made. These are: (1) the results in one unit under any condition of treatment do not influence the results in units receiving treatment at some later time; (2) treatment can be started in any unit at any time.

In summary, it is shown that the data from an experiment of the type under discussion lends itself to analysis, that the procedure considered has advantages over certain alternative procedures, and that the procedure under discussion may reasonably be adopted when the assumptions set forth are met. 81 pages. \$1.01. Mic 56-504

HISTORY

HISTORY, GENERAL

A SOCIAL, ECONOMIC, AND POLITICAL STUDY OF THE MORMONS IN WESTERN ILLINOIS, 1839-1846: A RE-EVALUATION

(Publication No. 14,653)

George R. Gayler, Ph.D.
Indiana University, 1955

This work is an analysis of the Mormon settlement in western Illinois, and of the reasons for its failure. It sets forth a combination of factors that swung the tide of "Gentile" public opinion against the Mormons, and it

presents the conclusion that the Mormons created the conditions that brought about this change of opinion. The religion of the Mormons was at most an excuse for the acts of "Gentile" resentment against the inhabitants of Nauvoo. A number of other factors were behind the "Gentile" attitudes that changed from the sympathetic reception extended them in 1839, to a violent hate and distrust of the Mormons resulting finally in a "Mormon War" and the expulsion of the Mormons from Illinois in 1845-1846. Unwise Mormon political activity can perhaps be singled out as the chief contributing reason for the growth of anti-Mormonism in western Illinois. Had Joseph Smith restricted his activity to the religious sphere, the outcome of the settlement at Nauvoo could

have been far different. Frontier politics was generally a delicate issue, and Smith's invasion of Illinois politics, his unwise switching of the Mormon vote from one party to another, and finally the announcement of his own candidacy for president aroused the distrust and hate of "Gentile" citizens. Furthermore, the Mormons continually alienated the press of Illinois, and this factor also had much to do with the rapid downfall of the Nauvoo theocracy. Continual propaganda broadsides were aimed at Nauvoo throughout the period, 1840-1845, and such attacks must have had a great influence on the non-Mormon citizens of Illinois. The political nature of the special city charters granted Nauvoo by an acquiescent state legislature was also a factor increasing Mormon unpopularity. Combined with these political issues, a number of other factors likewise contributed to the decline and fall of Nauvoo. One was Mormon stealing. Stories of Mormon theft that undoubtedly existed, but often greatly exaggerated, added fuel to the fires of "Gentile" resentment. Smith's ill-timed and unwise announcement of polygamy outraged the moral concepts of frontier citizens and served, like stories of theft, to alienate further Illinois "Gentiles," as did haughty attitudes of the Mormons who considered themselves as a "chosen people" destined to inherit the earth. Friendly Mormon attitudes toward the American Indian aroused the fear and resentment of frontiersmen; especially the Mormon religious concept that the Indians were their partners in inheriting the United States. Finally, in the character of Joseph Smith himself can be found a reason for the growth of unpopularity of the Mormons in Illinois. Joseph Smith evidently learned nothing from his unfortunate experiences in Ohio and Missouri. The Mormon leader's complete lack of tact as manifested in his frequent and unwise speeches cannot be ignored as acts contributing to Smith's ultimate assassination, and the ruination of his "Zion" at Nauvoo. Had Joseph Smith possessed the foresight to realize the direction his unwise political, social, and economic policies were leading, the history of the American frontier could have been saved from one of its more unfortunate episodes.

342 pages. \$4.28. Mic 56-505

LEVI WOODBURY--JACKSONIAN FINANCIER

(Publication No. 15,313)

Philip Damon Wheaton, Ph.D.
University of Maryland, 1955

Supervisor: Dr. David S. Sparks

When the appointment of Roger B. Taney as Secretary of the Treasury was rejected by the Senate in 1834, President Jackson chose as his successor, Levi Woodbury of New Hampshire. Woodbury, who had been a justice of the Supreme Court of New Hampshire, Governor of that state, a United States Senator, and the Secretary of the Navy, remained in the Treasury department until 1841. During that time, he played a major role in the political battles of the Bank War of the Jacksonian period.

The main tasks that confronted Woodbury as Secretary of the Treasury were the safe keeping of the public funds, and the regulation of the country's currency. Woodbury

attacked these problems in the spirit of a staunch Jacksonian. In administering the state bank deposit system which he had inherited from Taney, he sought to preserve the rights of states in the regulation of their own state banks, and to prevent undue interference in the affairs of government by the banking interests. When the deposit banks broke their contracts with the government by the suspension of specie payments, he worked assiduously for the administration plan for an independent treasury system, which he believed would more fully preserve the rights of states, and protect the federal government from the pressures of a privileged class.

Recognizing the necessity of banks, Woodbury was nevertheless in full agreement with the hard money theories of Jackson, and he worked diligently to supply specie for use in all small private transactions, and to provide proper backing of paper issues of bank currency. He advocated the gradual curtailment of the use of small bank notes by the federal government. He was in full agreement with Jackson's Specie Circular, and with the goal of the Van Buren administration that all government financial transactions be made wholly in specie, thus separating the federal government from all dependence upon private banks.

Woodbury was subjected to unmerciful attacks by the Whigs, and later by the Bank Democrats, who sought to prevent the administration from establishing an independent treasury. He had the dubious honor of being the chief scapegoat of the Panic of 1837, and demands for his resignation and impeachment became commonplace. His work received, however, the full support of both Jackson and Van Buren.

Modern scholars agree that the causes of the Panic of 1837 were fundamental and that the financial policies of the Treasury Department under Woodbury would not have prevented the depression. While no saviour for the nation's economy, Woodbury was a pretty fair physician, and he managed to ameliorate the effects of this major economic setback. In addition he provided the funds necessary to enable the government to conduct its business, and he did this without acquiring a substantial debt. He directed every measure towards the fulfillment of the Jacksonian program of separating the banking business from the concerns of government, thus preserving the independence of the government, and the rights of equal opportunity for all under that government. Playing his role stubbornly and relentlessly, Woodbury's accomplishments were a most important part of the movement of Jacksonian Democracy. 286 pages. \$3.58. Mic 56-506

HISTORY, MODERN

FRANKLIN D. ROOSEVELT'S FIGHT FOR THE
PRESIDENTIAL NOMINATION, 1928-1932

(Publication No. 15,190)

Earland Irving Carlson, Ph.D.
University of Illinois, 1955

A combination of circumstances and traits of availability placed Franklin D. Roosevelt in a position where he was able with the assistance of many friends to conduct a spirited four-year campaign for his party's presidential nomination. Roosevelt became a serious contender in 1928 when he was elected Governor of New York, an office which is a recognized stepping stone to the White House. His political assets quickly impressed many of the leaders in the rural wings of the Democracy who were bitterly opposed to the influence of the urban, dripping Wet wing of the party. He was intimately connected with the Wilsonian heritage; he was a vote-getter, a moderate Wet, a Protestant, and an upstate New Yorker, ostensibly free from the taint of Tammany. Such traits were in desirable contrast to the liabilities under which Alfred Smith had suffered in the recent presidential campaign. What further aligned Roosevelt with his sectional followers was the record which he made at Albany. As the depression spread from Wall Street to Main Street, his pronouncements on such issues as farm relief, water power, public utilities and conservation spotlighted him as a sympathetic spokesman for the Western and Southern Democrat.

Most of Roosevelt's pre-convention campaign was an undercover one. As is customary in American politics, he played down his presidential aspirations while he waited for his friends to create the impression that the office was seeking him, and not he the office. To accomplish this, he delegated the everyday conduct of the drive to his political triumvirate: Louis Howe, who supervised headquarters in New York City; James Farley, who ranged over the nation as Roosevelt's delegate-reaping leg man; and Edward Flynn, who operated behind the scenes as an adviser. Emphasizing the personal approach, they launched the greatest letter-writing campaign in the history of American politics. When Farley toured the West in the summer of 1931, he discovered that the name of Roosevelt was magic, as indeed it also was in the South. The recruitment of such party wheelhorses as Colonel Edward House, Homer Cummings and Senator Cordell Hull was another indication that Roosevelt's bandwagon was on the move.

Roosevelt threw his hat into the ring in January, 1932. Underscoring the success of his unofficial drive, headquarters by this time had received promises of support from state organizations representing more than a majority of the delegates to the convention. In the race for delegates, the friendly organizations, assisted by headquarters, concentrated on adapting Roosevelt's traits of availability to the prevailing political climate, especially in the West and South. Meanwhile, Roosevelt was declaring himself on national issues that bespoke his progressivism. He created consternation among his conservative opponents, for example, when he championed the cause of the "forgotten man," the economic underdog who was particularly feeling the effects of the depression. When the

pre-convention drive ended, it was obvious that only Roosevelt had a national following. He had triumphed in forty states and territories. The remaining states, primarily in the East, had remained faithful to Smith; several backed favorite sons; and Texas and California supported Speaker John Garner. Nevertheless, Roosevelt was still approximately 100 votes short of the required total to nominate under the party's two-thirds rule.

At the Chicago convention, the Smith coalition hoped to stop Roosevelt by deadlocking the gathering and then nominating a candidate of their own choosing. But Roosevelt's lines held on the first three ballots, and he swept to victory on the next one when Garner, fearing a repetition of the disastrous 1924 convention, swung behind him in return for second place on the ticket.

469 pages. \$5.86. Mic 56-507

JOHN LOTHROP MOTLEY

(Publication No. 15,629)

Marjorie Frye Gutheim, Ph.D.
Columbia University, 1955

John Lothrop Motley was born near Boston, Massachusetts on April 15, 1814. Before entering Harvard with the class of 1831 he attended Round Hill School in Northampton. After graduation from Harvard, Motley studied at the Universities of Göttingen and Berlin, where he became an intimate friend of Otto von Bismarck; he then toured Europe before returning to Boston in 1835. In 1837 he married Mary Elizabeth Benjamin, and two years later published his first book, Morton's Hope, which is chiefly important for the picture it gives of Motley's own early interests and ideas.

After a few months' service as Secretary of Legation in Russia, 1841-1842, Motley returned to Boston and resumed his literary work, publishing a second novel, Merry Mount, and several critical articles in the North American Review, "Peter the Great," "The Novels of Balzac," and "Polity of the Puritans." In these he expressed his developing ideas of literary production and government.

In the mid-1840's Motley began to collect materials for his major work, a history of the Netherlands. By 1851 he had decided he must consult European sources for his material. After several years of travel and extensive research in the Archives of Dresden, The Hague, Brussels, Paris and London, he published the first part of the history, The Rise of the Dutch Republic (from the abdication of Charles V in 1555 to the assassination of William of Orange in 1584.)

After a winter in Boston, during which he helped to found the Atlantic Monthly, Motley returned to Europe to continue research for the second part of his work, History of the United Netherlands (from the death of William to the Twelve Years' Truce in 1609). The first two volumes were published in 1860, the third and fourth in 1868.

In May 1861, Motley wrote for the London Times an able defense of the Union cause in the American Civil War. Appointed Minister to Austria, he served his country well, although he had to deal with no important questions except the

proposal to allow Maximilian of Mexico to recruit troops in Austria, a project which was dropped when the United States protested.

In 1867, Motley resigned his post and returned to the United States. The following year, he made an eloquent campaign speech for Grant and an address before the New York Historical Society on "Historic Progress and American Democracy;" in both of these he again expressed his ideas on government and his faith in the United States.

In the spring of 1869 he was appointed Minister to England, but his handling of the Alabama negotiations brought him into disfavor with President Grant and Secretary of State Fish and the negotiations were withdrawn from him. In July 1870 he was asked to resign, and when he refused, was recalled.

Once again Motley turned to history and in 1874 published *The Life and Death of John of Barneveld*, not a biography, but an account of the struggle between Barneveld and Maurice of Nassau for leadership in the Netherlands. Because of illness, he was forced to discontinue his work and was never able to write the history of the Thirty Years' War as he had planned. He died at Kingston Russell, Dorsetshire, England on May 29, 1877.

433 pages. \$5.41. Mic 56-508

BEN BUTLER: THE MAKING OF A RADICAL

(Publication No. 15,631)

Murray M. Horowitz, Ph.D.
Columbia University, 1955

Why did Benjamin F. Butler, a confirmed Democrat previously, gravitate to the other political pole and become a Radical Republican during the course of the Civil War? This is the central theme in limning this individual against the larger problems in which he became involved.

Butler was one of the Massachusetts delegates who switched their support from Douglas in 1860. The poor showing he made as the Breckinridge candidate for Governor helped convince him that drastic steps were needed to redeem his popularity. He broke his political ties when the War started. Through ingenious pressure, he received the command of the Massachusetts regiments from Governor Andrew. As Brigadier General, Butler opened the route to Washington. His seizure of Baltimore without authorization, however, caused the Administration to transfer him to Fortress Monroe.

Here he treated slaves who fled to his lines as "contraband," a popular stroke. But when he made pointed inquiries on their treatment elsewhere, he was superseded. To stimulate recruitments, Lincoln authorized him to raise troops for an expedition which ultimately occupied Louisiana.

Butler's administration of Louisiana was stormy, what with brushes with consuls, problems of ruling a hostile population, and efforts to restore trade and production. He was replaced in December, 1862 because of frequent complaints to the Secretary of State and because his position on the Emancipation Proclamation was not clear to Washington.

He emerged a strong figure, popular with the Northern populace, especially so with the Radicals who admired his

efforts at reconstruction, his treatment of the Southerners and of the Negroes. Angry at his dismissal, yet delighted at his reception back North, Butler spurned new appointments. He had hopes of being appointed to the Cabinet with Radical support, and even started to build himself up for the Presidential nomination. To keep his name in the news, he accepted command of the Department of Virginia and North Carolina in November, 1863.

Here Butler once more became embroiled in conflict with civil authority, and Lincoln ultimately had to intervene. As in Louisiana, Butler's connection with illegal trade and speculation was one of his weak points. The General's conduct, though, continued to gather Radical support.

Butler searched for the coup which would gain him the Presidency. His military efforts were uniformly unsuccessful, with a good measure of the responsibility falling on him. In July, Grant had decided to shear him of his field command, but reversed himself before the bellicose Butler. Still, Grant ordered his dismissal after the unfortunate expedition to Fort Fisher.

Butler's exploits in 1864 unfolded against a background of political ambition. The dissatisfaction with the progress of the War accentuated the dissatisfaction with Lincoln. The Radicals especially looked for a new figure. Butler later claimed he had turned down an offer to be Chase's running mate. His story that Lincoln made him a similar offer does not stand up. Even after Lincoln was renominated, Butler's followers continued to participate in the movements to replace the President. Butler was never more than a dark horse at best.

Butler's ties with the Radicals grew as the War progressed. His dismissal in January, 1865 was the final rebuff from the Administration, for he became a Radical openly. The cycle had run full course; the pro-slavery Democrat had become the Radical Republican. He continued to work for a seat in the Cabinet especially when Johnson took over. As the Radicals broke with Johnson, Butler went with them, rebuilding his strength in Massachusetts and cutting a national figure as well. He was elected to Congress in a campaign made notable by his demand for Johnson's impeachment. A new career lay before him there.

338 pages. \$4.23. Mic 56-509

THE BRITISH CONSERVATIVES: THEIR ATTITUDES TOWARD THE EMPIRE AND IMPERIAL POLICY, 1870-1895

(Publication No. 14,710)

Daniel Hummel Hosler, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Paul Knaplund

During the quarter-century, 1870-1895, the British Empire was the scene of feverish activity. It expanded greatly and much thought was given to its organization. The British Conservative Party emerged as a group which for reasons of domestic politics was pledged to the late nineteenth century brand of imperialism. The purpose of this study is to probe into and to evaluate the depth of the

devotion of individual Conservatives to the ideals of imperialism which have been ascribed to them. For this purpose, therefore, only politicians with a consistent record of voting in the total Conservative interest throughout the period, or in the case of the younger members on first entry into parliament, are considered.

The nearly one hundred Conservatives who showed interest in the empire or in any of the various phases of imperial activity during the period were, for the most part, men of similar background of birth, education and experience. They may be grouped into several categories according to that experience and background. Among these were: service officers sitting also in parliament, or men with long naval or military experience before entering politics; business men, frequently of Quaker or non-conformist background; professional lawyers; and, finally, professional (and ennobled amateur) politicians.

In many cases the interests and points of view of individual Conservatives were influenced by their experiences and backgrounds. Service members evinced most of their interest in matters of defense and in advocating military action leading to imperial expansion. On the other hand the arguments for and against tariff reform, the humanitarian aspects of native policy, and the movement for imperial unity provided the major concern of the business men. Individuals in the other groups could be found advocating or opposing policies as they chose. The primary fact is that the Conservatives of this period were men with individual interests, and while they usually voted with their party in division, they opposed or defended policies in any way they chose in the debates in parliament.

Of all the imperial activities during the quarter-century under review those of major interest to politicians as well as to the British public were highly publicised native wars and annexations which were so constantly in the news. On the other hand tariff reform, defense and imperial federation found their advocates among a select, interested few. These topics, for the most part, interested only the experts or fanatics, while annexation was a policy which intrigued the masses.

Because of this concern with imperial expansion the geographical areas of major interest were Africa and Asia; the relatively stable Australasian and Canadian colonies were seldom mentioned. The general feeling seems to have been that the Australians and Canadians could be trusted to keep out of trouble; therefore they could be safely ignored. The only times they were considered were occasions when they brought themselves to the attention of the British by clamors over foreign encroachment in nearby areas or by insistence on tariff reforms.

All things considered, the British Conservatives were men who knew their own minds. They could give sincere thought to the policies they advocated, or could pursue a policy out of spite for the purpose of embarrassing the Liberal governments which may have been doing exactly what the Conservatives would have done in similar circumstances. The furor created by the Conservatives over the Sudan debacle certainly illustrates this type of activity. The primary fact is that British Conservatives were not to a man the "Jingoes" that they have been too often considered, but were simply men who could foster or decry any policy presented to them, each as he saw fit in his own conscience.

277 pages. \$3.46. Mic 56-510

**PUBLISHED OPINION IN AMERICAN PERIODICALS,
AND SENATORIAL OPINION, CONCERNING
UNITED STATES POLICY ON THE ACQUISITION
OF OVERSEAS TERRITORY, 1878-1900**

(Publication No. 15,569)

Leonard Theodore Kreisman, Ph.D.
New York University, 1955

Chairman: Professor John C. Payne

The problem of American overseas expansion is one that is fairly familiar to students of American history. However, it would appear that there have been some significant gaps in the telling of this story particularly as concerns the role of public and senatorial opinion. This study surveys the role of public opinion, with primary emphasis on periodical materials in the years from 1878 to 1900. In addition, the views of members of the Senate, as reflected in periodical materials and official Senate records, are also examined.

Materials have been collected from a wide variety of periodicals. Through the use of individual catalogues as well as periodical indices an attempt has been made to examine all material which in any way touched on the problems of overseas expansion.

It has been necessary to limit this study in some respects. There are four major geographic areas which were explored. American interest in Samoa, Cuba, the Philippines and Hawaii has been traced from its beginnings up through the period of actual acquisition.

The uniqueness of the study is derived from the fact that there has been no attempt, however superficial, to ascertain the developing opinion with regard to these geographic areas. In addition, while occasional reference is made to a particular magazine article, there has been no attempt to explore the whole range of such materials.

In general, the findings indicate that it is very possible that there was a strong divergence of opinion in various sections of the country on overseas acquisitions. It can be stated with some security that the Western areas of the country were less fearful of the Cuban war than were similar interests in the East. In addition, the economic motivation for imperialism was much more highly developed in Western reaction than it was in the East. There was little if any evidence to indicate that the West resorted to emotionalism in an attempt to develop a continuing interest in the Spanish problem. The actual problem of acquisition was decided primarily along party lines, with Republicans favoring the addition of territory while the Democrats stood in opposition.

As concerns the role of public opinion, as viewed through the periodicals, it would seem that the public was treated to a fairly complete and impartial analysis of the various problems involved in acquiring overseas areas. There was ample material available to assist the citizen in making up his mind about the value of the various territories in which the United States became interested.

The main arguments for acquiring overseas territory have also been stated and their development has been traced. The findings seem to indicate that other than a certain amount of elaboration the arguments which were introduced in the early stages of the imperialistic effort were the same arguments in evidence at the end of the

great debate. It would also seem evident that the greatest elaboration in terms of a particular argument took place in the case of economic motivation. In the case of the Philippines it is apparent that the potential use of these islands as a Far Eastern base was a strong factor in helping the anti-war Eastern business interests change their minds about the values of the Cuban struggle.

The study has also revealed that there are significant and as yet unexplored gaps in the study of American imperialism. Certainly before the generalizations which have been applied to this era are accepted there is a need for additional studies on the public opinion phase of imperialism. There is only one good sectional study, which covers the editorial opinion of the Middle West on the Spanish-American War. There is a need for additional studies to cover the same material in Eastern, Southern and Far Western newspapers. In addition, similar attempts should be made to survey such opinion on Samoa, and Hawaii. Until these materials are forthcoming American historians must be extremely cautious in their statements about opinion and its influence during this historical phase of American development. As things currently stand the generalizations which have been made are predicated only upon an analysis of Eastern opinion and this study helps to demonstrate that Eastern sentiment was not necessarily that of the United States as a whole.

It is hoped that the analysis of periodical material which has been made will assist those who undertake the definitive analysis of public and senatorial opinion and its role in the American quest for overseas territories.

283 pages. \$3.54. Mic 56-511

**PROFILE OF A COLONIAL MERCHANT:
THOMAS CLIFFORD OF
PRE-REVOLUTIONARY PHILADELPHIA**

(Publication No. 15,635)

Grace Hutchison Larsen, Ph.D.
Columbia University, 1955

Thomas Clifford (1722-1793) was a prominent and successful merchant. When he moved to Philadelphia in 1743 from the vicinity of Bristol, Pennsylvania where he was born, he established himself in the cooperage business. From his shop, he branched out into a mercantile business which after his retirement in 1775, his sons carried on into the nineteenth century.

His trading career resembled that of many colonial merchants. He began by engaging in commission merchandising, sending ventures to the West Indies and selling European imports which at first he bought from another Philadelphia merchant. Soon he entered into temporary partnerships with leading merchants of the city in order to share in the ownership and management of trading vessels. After a few years, he was able to buy new vessels by himself and to increase both the size of his ventures and the geographic range of his trade. His growing prosperity was reflected in his purchase of waterfront property including a wharf, stores and house and in his acquisition of other city real estate as well as a handsome country place.

As a shipping merchant, Clifford tried to specialize in some area of trade. His failure to realize his ambition

was the major disappointment of his career. Since he never felt secure in any single branch of trade, he sent his vessels to any part of the Atlantic trading community where profits beckoned except to Africa where because of Quaker scruples he did not trade. Obtaining goods on freight for the return passage often made the difference between success and failure of a voyage; consequently, freight offers often determined the destination of his vessels.

He exported not only the diversified products of the Delaware River region but re-exported products brought into Philadelphia from other ports. Considerable ingenuity was required to accumulate valuable exports. To obtain sufficient quantities of iron of reliable quality, he maintained a position as Philadelphia factor to a Maryland ironworks from 1767 to 1772 despite the hostility of one of the owners, a New York merchant. Clifford's imports ranged from West Indian products to manufactured goods used by the colonists. Servants were favored imports because, like freight, they were a source of certain cash. At no time did he engage in smuggling enterprises.

Clifford depended as did other merchants on correspondents to negotiate his business outside his port of residence and reciprocated by caring for their business in Philadelphia. Correspondents handled the business of their employer's vessels, served as bankers, performed legal services, exchanged a variety of useful trade information, contributed to the equivalent of a credit rating service, trained the children of friends and business associates in mercantile pursuits and obliged other merchants in any way they could. For performing these various tasks, correspondents were paid in accordance with a generally accepted schedule of rates.

As wholesaler and retailer, Clifford enjoyed a cordial and often homely business relationship with inland storekeepers, farmers, ironmasters, millers, bakers and other artisans in the environs of Philadelphia and served numerous customers within the city. They bought his imports and supplied him with goods to sell. They also relied on him for additional services much as the merchant depended on overseas correspondents.

Unlike many prominent colonial merchants, including several Quakers of Philadelphia, Clifford did not participate in politics. Yet he supported the nonimportation agreements. He frequently complained of the adverse effect of imperial measures on American trade and hoped British merchants might persuade the government to adopt policies advantageous to all English businessmen. He endorsed the American Quaker policy of neutrality during the war but, unlike his sons, had more sympathy for the American than the British cause. During his retirement, Clifford continued his association with the American Philosophical Society and spent several years as an agent for one of William Penn's descendants.

461 pages. \$5.76. Mic 56-512

FRANCO-SPANISH RIVALRY FROM
THE TREATY OF CATEAU-CAMBRÉSIS
TO THE DEATH OF CHARLES IX

(Publication No. 15,377)

Michael O'Hara Henry Lavin, Ph.D.
Stanford University, 1955

The peace of western Europe was disturbed on a number of occasions during the course of the sixteenth century by conflicts arising from the rivalry between two great dynasties, the Hapsburgs of Spain and the Holy Roman Empire against the Valois-Bourbon line of France. As the leading power of the century, Spain sought by various means, including provoking of dissension among Frenchmen, to weaken and thus to draw France ever more securely into the Spanish orbit of influence.

Upon the death of Henry II in 1559 the French crown was inherited by a youth of fifteen years whose death, in the following year, brought to the throne a mere boy, Charles IX, who had not yet reached his eleventh year. During this reign, which lasted from 1560 to 1574, the king's authority was actually held by Charles' mother, Catherine de Medici. The queen mother was a clever, subtle but ambitious woman who promptly developed a policy of counter-balance through which she succeeded in preventing any one party from holding a dominant position over a long period of time. Such a policy, however, allowed the two greatest parties in France, the Orthodox Catholic and Huguenot, to remain sufficiently powerful to be able to plunge the nation into civil war on eight different occasions between 1562 and 1589.

To offset Spanish preponderance in Europe, France maintained the alliance with the Ottoman Empire into which it had entered earlier, and between 1569-1571 attempted to prevent the establishment of a league among the papacy, Venice, and Spain; failing in this, French diplomacy, following the battle of Lepanto, was directed towards disrupting the league. In pursuance of this policy the French government lent assistance to the Dutch rebels in Flanders at different times during those years. Although willing to render non-official, undercover aid to the faction in rebellion against Spain in the Netherlands, and to oppose the increase of Spanish power by semi-secret methods in other sections of Europe, Catherine de Medici could not bring herself to endorse an open break with Philip II whose great power she feared. It was, in fact continued insistence by Huguenot leaders that war be declared on Spain and their attempts to supplant the queen mother in the king's estimation which brought on the attempt against Coligny's life in August of 1572 and the massacre which followed on St. Bartholomew's Day.

The history of these events was studied by consulting state documents and diplomatic reports of various ambassadors, at present deposited in some of the principal libraries and archives of France, Spain, Italy, England, and other countries. A large number of published works, both primary and secondary sources, were also consulted in various European and American libraries.

A study of the numerous documents and primary sources related to these events reveal the great extent to which French national affairs were affected by the attitude of Spain. This coupled with the unstable conditions then prevailing within the kingdom caused France to undergo many years of civil and religious strife. As a result of

this highly unsatisfactory state into which affairs had fallen there came upon the French scene a new political party, the *politiques*, comprised in large measure of moderate Catholics who were opposed firmly to foreign intervention in the internal affairs of the nation and who favored granting toleration to the Huguenots in matters of religion so that peace and prosperity might be restored within the realm.

As has occurred repeatedly in the history of nations, the stronger power, Spain in this instance, attempted for nationalistic reasons to intervene in the affairs of its weaker neighbor. France, though less potent than Spain, was nevertheless a powerful nation which attempted to resist those intrusions, and by entering into alliances with other powers sought to counterbalance Spanish hegemony. Not until the closing years of the century, however, would Spanish influence decline markedly within the affairs of France. 654 pages. \$8.18. Mic 56-513

THE ROLE OF THE CHRISTIAN COLLEGES
IN MODERN CHINA BEFORE 1928

(Publication No. 15,498)

Jessie Gregory Lutz, Ph.D.
Cornell University, 1955

One facet of the expansion of Western civilization during the nineteenth century was the spread of Christian missions throughout the world. In China, missionaries faced particular difficulties because the Chinese belonged to a mature civilization which was hostile to foreign influences. Protestant missionaries established small schools to aid in converting Chinese, training assistants, and educating Christians. These early schools emphasized Christian doctrine, Chinese classics, mathematics, and science. Since they did not prepare students for commercial or government positions, they attracted only the poor who expected to enter mission employ. A few institutions evolved into colleges: Tengchow College, St. John's College, North China College, Peking University, Hangchow Presbyterian College. In the 1880's and 1890's several colleges added courses in English, which attracted merchants' sons desiring preparation for commercial and diplomatic positions.

Between 1895 and 1905, the equanimity of Chinese officials was shattered by Japan's victories over China and Russia, the Western scramble for Chinese concessions, and failure of the conservative Boxer reaction. Reform was demanded. A Western-style national educational system was devised, and the civil service examinations emphasizing the Chinese classics were abolished. Knowledge of mathematics, science, history, foreign languages became a prerequisite for government position. Chinese estimation of the Christian schools rose rapidly, and sons of the upper classes sought admittance. In response, missionaries founded new institutions: Shanghai Baptist College, Soochow University, West China Union University, Yale-in-China, Fukien Christian University; they united and enlarged old schools: Shantung Christian University, University of Nanking, Canton Christian College, Central China University, Yenching University. A

feeling of competition with government institutions encouraged missionaries to improve libraries and laboratories, raise entrance requirements, and increase the training of their teachers. They added vocational and professional courses. They established the first women's colleges in China: North China Union College for Women, Ginling, and Hwa Nan. Deterred by poverty and by evangelistic emphasis, the colleges still offered sub-standard education. Chinese and Western teachers lacked adequate training. Using English to teach Western subjects caused neglect of Chinese. Missionary dissatisfaction prompted re-examination and further raising of standards.

After 1917 the Chinese Renaissance encouraged nationalism, re-evaluation of Chinese and Western cultures, and admiration of science. Christianity was called unscientific and imperialism's handmaiden. Christian colleges were criticized for neglect of Chinese cultures, impractical curricula, required religious courses, and foreign control. The Chinese government demanded that: college boards of control have Chinese majorities, the colleges' religious purpose and compulsory religious courses be eliminated, the colleges be officially registered. Only after unification of China in 1928 by the Kuomintang did the colleges realize the necessity for immediate compliance. The first Christian colleges were registered in 1929; others shortly followed suit. They thus passed from foreign to Chinese regulation and gradually became integrated with Chinese life.

The total number of Christian college graduates before 1926 approximated only 4,500. About half of these entered mission work: Christian education, ministry, medicine. Others taught in Chinese schools. The colleges' training in English and Western civilization enabled a number to win scholarships for study abroad; several of these became outstanding statesmen. Many non-graduates, with their knowledge of English, entered business in the treaty ports. The Christian colleges were among the earliest examples of Western-type education in China; and, as Chinese became interested in Western civilization, they sought assistance from missionary educators in organizing schools. When Western contacts increased and a national school system had been devised, the influence of the Christian colleges in the general education field declined. Before 1928, however, the Christian colleges led in women's education and in such specialized training as medicine, nursing, agriculture.

381 pages. \$4.76. Mic 56-514

**THE LIFE OF DAVID RICE ATCHISON:
A STUDY IN THE POLITICS OF
A BORDER STATE**

(Publication No. 14,940)

William Earl Parrish, Ph.D.
University of Missouri, 1955

Supervisor: James L. Bugg, Jr.

Although David Rice Atchison ably served the state of Missouri as soldier, legislator, and judge, and represented its interests in the Senate of the United States from 1843 to 1855, people remember him today primarily, if at all,

as the "President of the United States for one day" or the leader of the "border ruffians" during the civil strife in Kansas Territory.

Yet from the beginning of his senatorial career, Atchison promoted westward expansion. He continued the efforts of his late predecessor, Lewis F. Linn, to organize the Oregon country and protect American settlers there in the early 1840's and saw this work successfully concluded. In the decade of the 1850's, Atchison became a leading proponent of the states' rights doctrine of John C. Calhoun, and in the struggle to apply its principles to the opening of new territories, looking to eventual statehood, none was more active than he. From the halls of Congress to the plains of Kansas, Atchison played a leading role in the South's attempt to enforce its "right" to take slavery into all territories of the Union.

Born in Kentucky in 1806, Atchison emigrated to western Missouri in 1830 to begin the practice of law. That region was in its infancy, and its early growth became indelibly connected with the name of David Rice Atchison. Settling in the frontier community of Liberty, Atchison served successively as commander of militia, state legislator, and circuit judge before being appointed to the United States Senate in 1843 upon the death of Linn. An ardent champion of expansion, especially in Oregon, he won the respect of his colleagues to such an extent that they elected him president *pro tem* of the Senate within three years after he entered that body. He consistently held this post by unanimous consent, with the exception of a two-year period from 1850 to 1852, until he voluntarily relinquished it in December of 1854.

Atchison split with his senior colleague, Thomas Hart Benton, in 1849 over the slavery issue and was primarily responsible for ending Benton's senatorial career two years later. The resultant division within the Missouri Democracy contributed to Atchison's own defeat in 1855, following which he turned his attention to the task of making Kansas a slave state. He had reached the summit of his senatorial career the previous winter with the repeal of the Missouri Compromise in which he played a major role. The Kansas struggle, in which Atchison was the recognized leader of the Southern effort, ended in ultimate defeat and undeserved malignment both for himself and for the South which he so devotedly served. This ended Atchison's public career except for a brief period of service as aide to Governor Claiborne F. Jackson during the first year of the Civil War. Following that conflict he retired to his Clinton county estate where he spent the remaining twenty years of his life.

300 pages. \$3.75. Mic 56-515

**THE DEMOCRATIC PARTY IN
PENNSYLVANIA, 1880-1896**

(Publication No. 15,117)

Lewis Wesley Rathgeber, Ph.D.
University of Pittsburgh, 1955

Between 1880 and 1896 the Democratic Party in Pennsylvania declined in voting strength and influence. By 1880, the party control of William A. Wallace, last Democratic Senator prior to Joseph F. Guffey had ended.

Samuel J. Randall, leader of the protective tariff Democrats and Speaker of the House of Representatives from 1876 to 1881, took his place. Randall's control of the party lasted until 1887 when Cleveland determined upon tariff revision. The Randall era witnessed the election of Robert Pattison, first Democratic Governor since 1860. Randall, through his long association with the State's Democrats, and use of patronage after Cleveland's election, was able to dominate the party.

Cleveland's determination on tariff revision brought to power William L. Scott, Congressman from Erie, and personal friend of the President. Scott destroyed Randall's power by taking control of patronage.

Scott, who was a wealthy industrialist, relinquished party control to William F. Harrity who came to the front through his management of the successful gubernatorial and election campaigns of Pattison, who was re-elected Governor in 1890. Harrity, personifying the rising Irish political leader in Pennsylvania, was chosen Democratic National Chairman in 1892 for his work at the Convention of 1892 when the Pennsylvania delegation, voting under the unit rule, was instrumental in Cleveland's nomination. His control of the party came to an abrupt end with the nomination of Bryan in 1896. Bryan and his lieutenants aided in returning control of the party to the Kerr-Guffey faction -- Harrity's opposition.

The party was affected by the three national issues of the period -- tariff, silver, and reform. The tariff was a factor leading to party decline. Democrats supported the protective tariff to the extent of condemning the Republicans for lowering tariff duties in 1872. Leading Democrats left the party following the adoption of tariff revision in 1887, although the full effects of the exodus to the Republicans were not felt until the depression of 1893, when Republicans in the State effectively pointed to Democratic tariff tinkering as the cause of the depression. The silver issue, coming soon after tariff revision, found many Pennsylvania Democrats strong for the gold standard, and out of line with what became party doctrine after the 1896 Convention. Pennsylvania was a financially conservative State and this, coupled with the fact that most Pennsylvania farmers were unaffected by agrarian unrest because of their comparatively prosperous circumstances, led to little support for free silver in Pennsylvania. Many more Democrats left the party over the silver issue.

Based on the issue of reform, the Democrats elected a Governor in 1882 and in 1890, but no other Democrat was elected in 1890, indicating the waning importance of reform.

Along with the tariff and silver issues, the other great factor leading to the party's downfall was its schizophrenic make-up. One wing of the party was rural along sociological lines, agrarian in economy, protestant in religion, conservative in relation to change, and Scotch-Irish and German in its ethnic background. That wing accepted the philosophical concepts of Jefferson and was strong in most areas outside of Philadelphia.

The other wing was urban in sociological make-up, laboring and industrial in economy, Catholic in religion, progressive in its tendency to accept the new post-Civil War ideas, and primarily Irish in ethnic background. Their philosophical source came from the period of Jackson and their European backgrounds.

Important source materials utilized for this monograph consist of the Samuel J. Randall, Cleveland, and Tilden

manuscripts, newspapers of the period, U. S. Census Reports, official records of the Democratic National Conventions, Pennsylvania Archives, Pennsylvania Legislative Record, and Smull's Legislative Handbook.

403 pages. \$5.04. Mic 56-516

RALPH CUDWORTH: FORLORN HOPE OF HUMANISM IN THE SEVENTEENTH CENTURY

(Publication No. 15,262)

Danton Bridgford Sailor, Ph.D.
University of Illinois, 1955

As the most systematic and prolific of the seventeenth-century group known as the Cambridge Platonists, Ralph Cudworth attempted to construct a great humanistic synthesis against overwhelming forces, both religious and secular. At the same time he was a successful administrator as Master of Christ's College at Cambridge, though the intellectual controversies in which he participated were projected into college politics by certain ambitious members who wished to displace him.

As a humanist, Cudworth received his major inspiration from classical antiquity, particularly from the Platonic tradition, but personal relationships were also quite influential. He enjoyed the close friendship of Benjamin Whichcote, who is frequently cited as the founder of the Platonist movement at Cambridge. Henry More was virtually an alter ego, so close was their lifelong friendship and the correspondence of their ideas. Cudworth had personal ties also with such prominent figures as Phillipe van Limborch, John Smith, and John Worthington. Unfortunately, his hypersensitivity threatened at one time to disrupt even his friendship with Henry More.

Cambridge Platonism was first identified with Latitudinarianism, providing the intellectual basis for its opposition to the extremism of Calvinism and the enthusiastic sects. To Cudworth, Divine Fatalism, his term for Calvinism, represented a comprehensive repudiation of humanism by its emphasis upon the omnipotence and arbitrariness of God, the degradation of man and his subjection to predestination. Cudworth's attack was two-fold. Against the idea of an arbitrary God, he argued that there are eternal and immutable essences which God cannot change any more than He can change His own essence, which is Perfection or Goodness and not omnipotence. Reflecting the characteristic interest of his group in ethics, he protested that God thereby cannot make wrong to be right or truth to be untruth. Epistemologically, he sought to show that the objects of knowledge are eternal and immutable, independent alike of an arbitrary God or mechanistic matter. Yet, in the second place, Cudworth insisted that within the framework of these eternal and immutable principles, man must have freewill. He based this upon the assumption that the human soul is capable of self-activity, a key attribute of all incorporeal substance. Freewill is obvious, he argued, from the simple fact that we commit both logical and moral error.

But, the appearance of certain secular philosophies in the mid-Seventeenth Century and particularly that of Thomas Hobbes, forced the Platonists to defend the logic of religion itself. Perhaps the most typically humanistic

of Cudworth's ideas was his assumption that all truth and error had been expressed in classical antiquity, that therefore the ideas of Hobbes, Bacon, Descartes, Gassendi, and Spinoza were merely restitutions of ancient systems, just as were his own views. In his refutation of the resurrected Materialistic Atheism of Hobbes, which he presented in his magnum opus, The True Intellectual System of the Universe, Cudworth demonstrated the existence of the incorporeal by showing that motion, life, and thought could never have originated in matter.

The paradox of Cambridge Platonism was that its efforts were in inverse ratio to the historical significance of its opponents. Thus, Cudworth regarded the other contemporary philosophers as merely erring Theists, whereas they really contributed much more than Hobbes to the seventeenth-century divorce between Nature and God. The paradox was particularly sharp in the case of the Royal Society which, because of the conspicuous piety of many of its greatest members, appeared to be the Platonists' truest ally, but which, through its promotion of the scientific spirit, ultimately contributed the most to the disregard of traditional humanistic values.

355 pages. \$4.44. Mic 56-517

**REDSKINS, RUFFLESHIRTS AND REDNECKS:
INDIAN ALLOTMENTS IN ALABAMA
AND MISSISSIPPI, 1830-1860**

(Publication No. 15,442)

Mary Elizabeth Young, Ph.D.
Cornell University, 1955

The purpose of the study is to examine the formulation and application of the allotment and trust policies for disposing of lands ceded by Indian tribes in Alabama and Mississippi, where these methods were first used on a large scale. Analysis of the conflicts issuing in the Indian Removal Act of 1830, and the negotiation of treaties with the Choctaw, Chickasaw, and Creek tribes giving heads of families in each of these tribes allotments of land in severalty with the right to sell these allotments under federal supervision indicates that the adoption of the allotment policy was designed to resolve certain specific conflicts among the groups responsible for negotiations: humanitarians were to be mollified by the donation to the Indian of that portion of his lands which he cultivated, and therefore most "deserved" to retain. Since the remaining lands were to be opened for sale and settlement, the object

of the Jackson administration was also satisfied. Indian chiefs could promise their followers an apparent alternative between emigrating west and remaining in their ancient homes.

A study of the administration of the three treaties indicates that this resolution was a false compromise. The dominant motive behind federal administration of the allotment policy was the opening of lands to exploitation. The War Department condoned intrusion on the ceded lands, and encouraged speculators to buy allotments. Private coercion replaced public power in enforcing the "voluntary" sale of the lands remaining in Indian ownership and the removal of the tribesmen. The result of this method was to allow speculators in Indian titles virtually to pre-empt four and a half million acres in eastern Alabama and northern Mississippi. Whether or not this pre-emption was profitable is nearly impossible to determine. Although the lands usually sold for more than they cost, the pace of settlement limited average profits to a lower scale than had been anticipated; in a number of cases, less than the going rate of interest on capital.

Speculation probably delayed settlement and contributed to the failure of settlers in acquiring ownership; it had little direct effect on the pattern of land-holding established when the areas where speculation prevailed reached a stable rate of population growth. That the effect of Indian land policies on the initial pattern of land distribution was not wholly determinate is illustrated by the sales of trust lands in the Chickasaw cession. Here the land remaining after the location of allotments was sold by the government and the proceeds retained as a trust fund for the tribe. To insure rapid offering of the Indian lands and graduation of their price, the treaty negotiators sacrificed the pre-emption principle. Offering the lands within two years of their cession led to the engrossment of first-choice lands, but graduation of prices accelerated settlement of the poorer portions of the territory.

The operation of these policies was consonant with the free contractual public land system of the eighteen thirties and forties, implemented by the offering of areas for sale as quickly as possible, giving settlers free choice in selecting a home and speculators opportunity to forestall or outbid them. Speculative profit and engrossment was curbed by competitive offering of public lands rather than by limiting entries to settlers and restricting their freedom to sell it. In applying the principles of voluntarism to Indian tribes and the disposal of their lands, the government developed a method of disposing of lands outside the public domain system, often less egalitarian in its operation than the standard public land laws.

305 pages. \$3.81. Mic 56-518

HOME ECONOMICS

THE ABSORPTION OF IRON BY NINE COLLEGE WOMEN FROM FERRIC ORTHOPHOSPHATE AND FERROUS SULPHATE INCORPORATED INTO BREAD

(Publication No. 15,598)

Inez Kemble Harrill, Ph.D.
Cornell University, 1955

Young women were maintained on a diet of low iron content for a control period of 28 days. Following this ferrous sulphate or ferric orthophosphate were incorporated into bread and fed in addition for 28-day periods. The iron content of the food and the feces was determined. The mean intake of iron during the control period, ferrous sulphate and ferric phosphate enrichment periods was 5.43 mg., 12.75 mg., and 12.40 mg., respectively. The amount of iron excreted in the feces averaged 4.41 mg. during the control period and 11.51 mg. and 11.28 mg. during the ferrous sulphate period and the ferric phosphate period, respectively.

The amount of iron absorbed from each iron preparation was determined by finding the difference between the increase in the amount of iron in the food and the increase in the amount of iron in the feces due to the addition of fortified bread to the diet. The mean for the amount of iron absorbed from ferrous sulphate bread was 0.26 mg. or four per cent and the mean for the amount of iron absorbed from the ferric orthophosphate bread was 0.19 mg. or three per cent. On each iron preparation four subjects apparently absorbed no iron from the added preparations and two absorbed large amounts. The small amount of iron absorbed from the ferrous sulphate and ferric phosphate incorporated into bread indicates that the addition of a larger amount of the iron preparations for the fortification of bread and flour would be of nutritional value.

The mean hemoglobin level for 9 subjects was 13.5 gm. per 100 ml. of blood. There was no significant change of the hemoglobin values during the experiment. The mean serum iron level for six subjects determined eight months following the termination of the study was 142.8 mcg. with a range of 97.0 mcg. through 186.0 mcg. per 100 ml. of serum. The subject who had the highest hemoglobin concentration and serum iron level absorbed an unusually large amount of iron. Apparently the high percentage of absorption was not due to poor stores.

66 pages. \$1.00. Mic 56-519

ATTITUDES AND EXPERIENCES OF TEN- AND ELEVEN-YEAR-OLD 4-H CLUB MEMBERS ENROLLED IN CLOTHING PROJECTS IN McLEAN COUNTY, ILLINOIS IN 1953 WITH IMPLICATIONS FOR PROGRAM PLANNING

(Publication No. 15,428)

Lucile Hieser Sevoian, Ph.D.
Cornell University, 1955

This study dealt with an investigation of the opinions and experiences of 10- and 11-year-old 4-H Club members enrolled in clothing projects in McLean County, Illinois. The purpose of the study was to determine what concepts these members had of 4-H Club work and to discover indications of satisfactions derived from the 4-H Club experience in relation to developmental tasks.

The data were secured by means of personal interviews conducted by the author with the club members at the close of the 1953 4-H Club year. Three-fourths of the interviews were obtained in schools and one-fourth in homes. Data were obtained from 128 girls or 98 per cent of all the 10- and 11-year-olds enrolled in 4-H clothing projects in McLean County. The facts that responses were obtained from such a high percentage of the potential population of the study, were willingly given, and were consistent within the individual interview contribute evidence to the validity and reliability of the data.

Analysis of the data was made on the basis of the total population of 128 girls and of comparisons by the four major classifications of (1) years in club work or clothing project unit—first and second, (2) rating on garment exhibited at the county 4-H Club show, (3) residence—farm and non-farm, and (4) family socio-economic status—low and high family socio-economic groups derived on the basis of the number of selected indicators of socio-economic status possessed by the members' families.

This study has served to demonstrate the possibility of obtaining data on opinions and experiences of 4-H Club members from even the youngest age group in 4-H, the willingness of club members to cooperate in such a study, and the value of letting club members speak for themselves.

The data indicated that both the opportunities for experiences within the 4-H Club program and the actual experiences of the members varied in many respects. However, there was a consistency in their opinions of the role of the project in relation to the over-all program. The most important phase of the club program to these members was the project work. Major ideas other than project work in their concept of 4-H were learning to do things, having fun, and having activities such as tours, camps, parties, and the county 4-H Club show.

Indications were found that most of the club members received satisfactions from the 4-H experience in relation to the areas of developmental tasks within the scope of this study. However, they may have received these

satisfactions in different ways and in varying degrees. Although girls joined 4-H primarily because of the influence of others, they re-enrolled a second year because of their own interest. Classifications of members who were most active participants in the 4-H Club program were members in their second year of club work, members receiving first or second place ratings on garments, farm members, and members in the high family socio-economic group. Some of the members who apparently had the least satisfying 4-H Club experience continued in 4-H Club work while others of them dropped out. Although some members had very satisfying experiences in 4-H Club work,

they dropped out because of competing interests or circumstances beyond their control.

Major implications of the findings for planning the 4-H program included revising project requirements in the second clothing unit, getting more information to mothers on recommended clothing practices and construction procedures, and giving more recognition in the local club for completion of all 4-H requirements.

It is recommended that similar studies be made of other project work in the 4-H Club program and of the opinions and experiences of other age groups.

243 pages. \$3.04. Mic 56-520

JOURNALISM

THE CONCEPT OF OBJECTIVITY IN JOURNALISM IN THE UNITED STATES

(Publication No. 15,578)

Ronald Shilen, Ph.D.
New York University, 1955

Chairman: Professor George E. Axtelle

This study traces the origin and development of the concept of objectivity in journalism in colonial America and in the United States. It analyzes the significance of objectivity as a criterion in contemporary news practices.

The study is in three parts, the first of which inquires into the aims and ideals of the newspapers of the American colonies; into the principles and practices of newswriting during the Revolutionary War; and into the nature and course of news standards throughout the history of the press in the United States. The emphasis is on the growth or lapse of such news criteria as accuracy, truth, significance, comprehensiveness and fairness.

The colonial printers started with pledges to report the news truthfully and factually and then found it increasingly difficult to be non-partisan in matters of colony-Crown relations. There were only "Tory" and "Patriot" papers, no neutrals. After the American Revolution the press engaged in calumny, scurrility and blatancy. Even so great a champion of a free press as Jefferson thought the people could be better informed by not reading the newspapers, so inaccurate and "polluted" were they, he said.

The "penny" papers of the 1830's were independent and popular. They constituted a "revolution in news" stressing local news spiced with crime, sex and "human-interest." Greeley, Raymond and Bowles had much to do with separating editorial opinion from the news. The "New Journalism" of the fourth quarter of the nineteenth century, with such names as Pulitzer, Dana, Hearst, Godkin, and Scripps represented a great surge forward for the practice of news objectivity.

The second part of the study examines the idea of objectivity as it is understood in the physical and social sciences, and in law. A number of authorities in these areas identify the concept of objectivity as a function of

procedure, not substantive in character; one which cannot be separated from the persons involved in the process. The impossibility of total objectivity is emphasized and the inevitable and limiting "subjectivities" are discussed.

Some of the philosophers and scientists who are quoted achieve consensus around the "objective relativist" position in philosophy. This is expressed in terms of "multiple perspectives," or differing views of the same, all real and none necessarily untrue because there are more than one. Other names for it are "relationism," "contextualism," and "perspectivism."

The last part of the study examines in detail many appreciations of objectivity by newspapermen. In the last seventy-five years the press has achieved a high degree of success in separating "fact" from "opinion" in the news, but within the last three decades there has arisen a growing dissatisfaction with the consequences of strictly objective news. Recently some newsmen have written and spoken of "spurious objectivity," "arid factuality," "slavish objectivity," "deadpan reporting," "outdated fiction" and the "myth of objectivity," denoting doubts concerning this tradition of American journalism.

Interpretation of news, once shunned, has, under the impact of weekly news magazine and signed newspaper columns together with the wider and swifter coverage, come to occupy a larger and increasingly acceptable role in journalism.

Instead of construing objectivity and interpretation as Scylla and Charybdis in the journalistic seas, both are viewed as heroes with flaws as in Greek tragedy. In general, objectivity in journalism can only be described as "a semantic will-o'-the-wisp." Yet as an ideal it continues to contribute a challenge to newsmen --- to write the news in a way that combines reality and justice.

194 pages. \$2.43. Mic 56-521

EXPERIMENTS IN AESTHETIC COMMUNICATIONS

(Publication No. 15,280)

William Thomas Tucker, Ph.D.
University of Illinois, 1955

The central purpose of the experiments was to provide a practical demonstration of the way in which sign theory and a mediation hypothesis of human learning applied to the particular problems of aesthetics. The specific hypotheses tested were:

1. Aesthetic objects can best be studied as signs having inter-individual communality of connotation;
- 2a. Artists and non-artists respond differently to the same aesthetic objects either because of different semantic structures, different modes of perception, or both;
- b. Artists should have markedly greater agreement on the connotative meanings of paintings than non-artists;
3. Clarity in connotative meaning is not dependent upon clarity of denotative meaning;
4. Certain artistic techniques or forms and colors can be related to whatever semantic factors can be isolated;
5. The terminology and semantic structure of individuals judging aesthetic objects may differ from the terms and structure located by Osgood and Suci.¹

Groups of both artists and non-artists judged representational and abstract paintings on a large number of seven-point scales, defined by polar terms frequently used

to describe paintings. These results were factored. Using scales which represented the factors located, other observers judged a larger number of abstract paintings. Later, polar terms representing the same factors were illustrated as abstractions by a group of art students.

The conclusions reached on the various hypotheses were:

Hypothesis 1: accepted because the method differentiated among paintings and observers in intuitively acceptable ways;

Hypothesis 2a: accepted since semantic structures differed between artists and non-artists;

Hypothesis 2b: accepted at the .01 confidence level on the basis of an F test for homogeneity of variance;

Hypothesis 3: accepted for artist observers; rejected for non-artists;

Hypothesis 4: not clearly determined by the evidence, although much favorable data was located;

Hypothesis 5: accepted, although the differences related only to specific terms and the proportion of variance accounted for by the various factors. The factors located were clearly identifiable with the Evaluative, Potency, and Activity factors located by Osgood and Suci.

115 pages. \$1.44. Mic 56-522

1. C. E. Osgood and George J. Suci, "Factor Analysis of Meaning," to be published in Journal of Experimental Psychology, 1955.

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

THE REPUTATION OF
DAVID HUME IN AMERICA

(Publication No. 15,665)

Earl Burk Braly, Ph.D.
The University of Texas, 1955

In letters and conversations during a thirty-year period between an unconsummated trip to America in 1746 and his death in 1776, David Hume expressed interest in the fate of Britain's colonies across the Atlantic. As a man of letters, he also was concerned about his reputation in the New World.

Survey and analysis of what Hume connoted to inhabitants of the American colonies and republic, particularly from the time A Treatise of Human Nature was published in 1739 until various learned commentaries on his works made their appearance in mid-nineteenth-century America, comprise this investigation. To ascertain the repute of Hume in this country, division of labor was found to be necessary with respect not only to source material but also to periods and subjects. The following temporal segments were adopted: the lifetime of Hume, and the end of which coincides almost precisely with the signing of the Declaration of Independence; the period of Constitutional drafting and ratification; the first quarter of the nineteenth

century, an era dominated by Thomas Jefferson, and the age of Andrew Jackson's political influence, reaching to 1850. Several aspects of Hume are considered: le bon David, the literary stylist, the historian, the political economist, the "infidel," and the philosopher.

The American popularity of Hume as writer and historian was unquestioned in the eighteenth and nineteenth centuries and, although the political implications of his History did not go unchallenged, the literary excellence of this work was acknowledged even by those like Jefferson who decried its supposed Tory leanings. The History of England was a staple part of the reading of students and their cultivated elders. Hume also was a leading figure in at least two other social sciences, government and economics. Key men in the framing of the Declaration of Independence and the United States Constitution were familiar with his political theories. The writers of America's first treatises on economics discussed and respected Hume's views on that subject.

Hume as philosopher was considered primarily in religious contexts by American clergymen-professors, beginning with John Witherspoon and other naïve realists, who followed Thomas Reid of Aberdeen. Attacks on Hume were chiefly in the British tradition of denouncing his scepticism because of its kinship to atheism. Material and spiritual substance, the causal relation, personal identity and immortality, and the credibility of miracles all were stoutly defended in opposition to Hume's

philosophic suspension of judgment, but the defenders chose to fight their battles on religious rather than metaphysical or epistemological grounds.

The place of Hume in the background of the American Transcendentalist movement is a significant problem in the history of ideas. Most of Hume's connection with Transcendentalism is by way of Immanuel Kant, who owed considerable debt to him, but some of the leading exponents of this viewpoint, including William Ellery Channing and Ralph Waldo Emerson, were students of Hume.

Impartial, non-religious examination of Hume is so rare among early American philosophical writers that objective works like Joseph Buchanan's *The Philosophy of Human Nature* (1812), Richard Hildreth's *Theory of Morals* (1844), and L. P. Hickok's *Rational Psychology* (1848), all of which are sympathetic toward Hume, appear emancipated and modern. They demonstrate that the philosopher and *le bon David* were not always overshadowed in American eyes by the "great infidel."

Although the present study does not extend beyond 1850, it has been observed that two great American thinkers of the twentieth century, John Dewey and Albert Einstein, have given Hume credit for helping them to advance the frontiers of ethical and scientific knowledge. When David Hume, philosopher and man of letters, declared that he must look to America for justice, his hopes were not misplaced. 331 pages. \$4.14. Mic 56-523

LANGUAGE AND LITERATURE, LINGUISTICS

MIDDLE ENGLISH MIRACLES OF THE VIRGIN: INDEPENDENT TALES IN VERSE

(Publication No. 15,622)

Beverly Mary Boyd, Ph.D.
Columbia University, 1955

Miracles of the Virgin are accounts of marvels wrought through the intercession of the Blessed Virgin Mary. Found as sermon exempla in the writings of the fathers of the Church as early as the fourth century, these legends became very popular in the period extending from the eleventh century to the fifteenth. Scribes assembled them into collections that rank among the most important literary works of their time.

A few important collection of miracles of the Virgin have come down to us in Middle English. The three major collections are the group of five tales found in some manuscripts of *The South English Legendary* (late thirteenth century or early fourteenth), the nine extant tales of an original group of forty-two tales in MS. Vernon of the Bodleian Library (c.1385), and the collection of eighteen tales in Additional MS. 39,996 of the British Museum (first half fifteenth century). The minor collections are the prose miracles of the Virgin in the *Festial* of John Mirk, composed shortly before 1415, and those in MS. 432 of the Lambeth Library, also from the fifteenth century. The remaining Middle English collections of miracles of the Virgin are translations.

In addition to the collections of miracles of the Virgin, there are a number of independent tales. Outstanding among these is Chaucer's *Prioress's Tale*, which exercised a great deal of influence over his contemporaries John Lydgate (c.1370-c.1450) and Thomas Hoccleve (c.1368-c.1437). Lydgate's *The Legend of Dan Joos* belongs, like *The Prioress's Tale*, to a cycle of miracles of the Virgin in which a miraculous object is found in the mouth of a person who has honored the Virgin Mary. Hoccleve's *The Monk and the Blessed Virgin's Sleeves*, hitherto accepted as an original work, is actually a version of a poem found in MS. Auchinleck of the National Library of Scotland (1330-1340) and in at least one older manuscript. Written in rime royal, which Chaucer is said to have invented, both poems are strongly influenced by Chaucer's literary style.

Besides these works, there are a few miracles of the Virgin by poets whose names have not come down to us. The most important of these is *The Romance of Theophilus*, in MS. Rawlinson Poetry 225 of the Bodleian Library (second half fifteenth century). Although there have been several attempts to explain the poem's peculiarities as evidence of adaptation from a miracle-play, they can be explained more simply as the conventions of Middle English tail-rime romances.

The remaining miracles of the Virgin are all incomplete. *The Clerk Who Would See the Blessed Virgin*, in MS. Auchinleck, lacks an introduction through the loss of a leaf, and *The Good Knight and His Jealous Wife*, in MS. Ashmole 61 of the Bodleian Library (late fifteenth century), lacks a conclusion. Nothing is known about the background of either poem. *The Wicked Knight and the Friar*, in MS. A.5.2 of the Lincoln Cathedral Library (c.1440), is so badly damaged that only the beginning and the end are preserved, while *The Child and the Abbot*, in MS. Harley 2,380 of the British Museum (late fifteenth century or early sixteenth) is in many places blurred beyond legibility. While it is not possible to estimate how much manuscript material has been lost, it is probable that there were other miracles of the Virgin in Middle English. 179 pages. \$2.24. Mic 56-524

THE LANGUAGE OF THE KATHLAMET CHINOOK

(Publication No. 14,656)

Dell Hathaway Hymes, Ph.D.
Indiana University, 1955

This dissertation describes a now extinct dialect of the Upper Chinook language, spoken formerly near the mouth of the Columbia River in Oregon and Washington. Its purpose is to elucidate Kathlamet structure, and extend the descriptive base for comparative and historical studies of the Chinookan family and Penutian phylum. Its problem is to apply methods developed primarily for an open corpus, partially elicited, to a closed corpus consisting solely of texts.

The present corpus is the Kathlamet texts collected in 1891 and 1894-5 by Franz Boas from the last speaker capable of dictation. The first step has been to prepare a file of 3x5 slips for all forms in Kathlamet Texts.

Comparison of these made possible elimination of variants due to errors of printing or transcription, a step analogous to the establishment of the text necessary in much philology. The actual analysis, however, has not been a strictly closed corpus problem, for work on Kathlamet Texts has been influenced by previous sketches of Chinookan dialects by Boas, Sapir and Dyk, based on field work. The linguistic analysis, then, consists of (a) what are essentially structural restatements of earlier descriptions for open, partially elicited corpora, where Kathlamet is like the described dialects (Shoalwater Chinook, Wishram); (b) original description based on a closed textual corpus where Kathlamet differs from the described dialects, or the matter has not been presented previously (e.g., particle stems, consonant clusters); (c) original discoveries about Chinookan structure, applied to Kathlamet, but occasioned by field work in the related Wasco dialect (e.g., the existence of a major form-class of pronouns).

The contrast between the present work and earlier treatments of Chinookan dialects is not especially that of open vs. closed corpus, therefore, because work with the former by others and the author has exerted so much influence on the present work with Kathlamet. The deeper contrast is in linguistic statement. Here a modern phonemic treatment is given (although morphophonemics remain scattered through the morphology as with Boas). Definite commitments are made in the identification of morphemes by assigning index numbers to all but members of stem classes, with decimal points for morpheme alternants. While the Boasian principle of describing each language in terms of its own genius is accepted, the use of index numbers makes Kathlamet more easily comparable to other languages. If for the other Penutian languages there were descriptions employing the method used here, and by Wonderly for Zoque, Garvin for Kutenai, Croft for Nahuatl, and Robinett for Hidatsa, comparative Penutian could soon be established. The indexing method, while facilitating wide comparison, concedes nothing of the rigor in the Boasian principle of unique description for each language; the inductive assignment of numbers reflects, not constrains, the "native genius" of each structure.

The use of index numbers, irrespective of phonemic shape of morphemes, highlights (1) positional slots, or relative order, and (2) actual occurrences in a closed corpus. The use of letters for word classes makes possible an economical statement of phrase sequences, i.e., combinations of words, parallel to the use of index numbers for an economical statement of morpheme sequences within words.

317 pages. \$3.96. Mic 56-525

AN ANALYSIS OF ENGLISH LOANWORDS IN NEW YORK CITY GREEK

(Publication No. 15,638)

James Macris, Ph.D.
Columbia University, 1955

This dissertation comprises an analysis, in terms of the two sound systems which are in contact, of a selected number of American English loanwords used by speakers

of Greek in New York City. The first chapter deals with the environment in which the contact takes place. This is followed by a discussion of the informants and of the methods used in the collection of the data. Of the twenty informants, ten have arrived in the United States in recent years. Nine of them were born in Greece, and the tenth was born in Romania of Greek parents. The other ten informants are children of Greek immigrants who were born in the United States. There were three female and seventeen male informants, with ages ranging from 18 to 43. Thirteen of the informants were between 21 and 25 years of age. Many of the informants were students.

A questionnaire was used consisting of twelve questions intended to elicit personal data about the informant and 212 English sentences to be rendered into Greek. The English questions and sentences as read by the informants, together with their responses in Greek, were recorded on tape, and these recordings formed the basis of the study.

A synchronic description of the sound system of present-day Greek is given, followed by a similar description of New York City English. Then the results of the contact between these two phonemic systems are presented. Examples are cited of English loanwords which have been adapted to the sound system of Greek in New York City. It is shown that the sound substitutions can to a great extent be predicted on the basis of a knowledge of the two phonemic systems. The last chapter is devoted to the loanwords in the lexicon of Greek in New York City and their grammatical integration.

The appendices consist of relevant data about the informants, the questionnaire, and a list of some 1,200 nouns which have been borrowed from English by speakers of Greek in New York City.

178 pages. \$2.23. Mic 56-526

SYNTAX OF COLLOQUIAL EAST ARMENIAN

(Publication No. 15,430)

Earl Wilson Stevick, Ph.D.
Cornell University, 1955

This study examines a 10,000-running-word sample of an East Armenian idiolect. The bulk of the study is concerned with what is traditionally labelled "syntax". Phonology and inflectional morphology are, however, summarized in a preliminary chapter.

The study describes the most frequent Armenian sentence-type, called "predication", as well as the most important constructions which occur within it on various hierarchical levels. The basis for description is the relative distribution of segmental elements; analysis of suprasegmental features, though recognized as indispensable for a complete picture of Armenian syntax, is omitted.

In dividing forms into their immediate constituents, an attempt is made to treat as partners in a single construction those elements between which some kind of formally storable dependence exists. At times, this principle leads to cuts within words before all inter-word cuts have been made. That is, the traditional line between morphology and syntax is disregarded at several points.

The three major word classes, which are defined in morphological terms, are subclassified by means of

syntactic criteria. Chapter 3 describes the elements which serve as subjects of predications, and the ways in which they are paired off with the person-number morphemes of finite verbs.

Chapter 4 subdivides one of the major word classes, substantives, and discusses the structure of complex substantival expressions.

Chapter 5 describes complex verbal constructions, differentiates among several types of elements which are members neither of subject nor of verb, and gives a detailed account of the predicates built around the ten most frequent verbs in the sample.

Chapter 6 summarizes the construction types found in the sample.

An appendix illustrates, with a short connected text, the way in which the analysis may be applied.

A second appendix contains a representative listing of items for which the analysis does not account.

In addition to providing, within the limitations set forth above, a survey of East Armenian syntax, this study also illustrates some of the advantages and disadvantages, for descriptive syntax, of an immediate-constituent approach which is willing to ignore the morphology-syntax dichotomy.

135 pages. \$1.69. Mic 56-527

LANGUAGE AND LITERATURE, MODERN

THE PROBLEM OF CRÉBILLON films

(Publication No. 15,356)

Robert-Peter Aby, Ph.D.
Stanford University, 1955

The problem of Cr  billon films is easily stated: he is an exceptional writer, a master of entertainment, one of the most important figures in the foundation of the modern novel, and one of the most perceptive emotional analysts the French have produced; why then is he not recognized as a master by the French academic and scholarly world, but shunned when not ignored? The proof of the first part of this statement and an answer to the latter part are the material of this dissertation.

Although Claude-Prosper Jolyot de Cr  billon, le fils has never been completely forgotten in the century and a half since his death in 1777, he has never been the subject of a thorough critical consideration; few of the manuals of literary history even mention him, those which do merely echoing each other. He has been the object of a disdain, a moral stigma which is unwarranted. The thesis is advanced that this reputation is due not only to the prudery of the Nineteenth Century historians, but to the malice of Cr  billon's contemporaries who are their sources of information.

Even the facts and dates of Cr  billon's life have been distorted and falsified. Therefore, the work on his biography has been an effort of collation rather than a search for new material. Never before has all the available material on Cr  billon been collected into one place, examined for reliability, its sources noted, and arranged chronologically.

Each of his works has been discussed and evaluated; he is shown to be not only the originator, and master, of several literary techniques, such as the epistolary novel and the use of dialogue in fiction, a dazzlingly clever and witty writer, but also a biting satirist of the manners of his period, and the creator of a hardy libertin morality which is extremely modern in tone and import, and which has been completely ignored. Many quotations from his works are offered in illustration of these facts; they are given in the original language and translated for the convenience of students who may not be able to read the original.

The purpose of the dissertation is to provide, in one place, for the convenience of students, as much information as exists about Cr  billon le fils, a critical discussion and evaluation of his work, and a proof of the thesis that this work is neither disgraceful nor unimportant.

394 pages. \$4.93. Mic 56-528

BYRON AND THE EARLY VICTORIANS — A STUDY OF HIS POETIC INFLUENCE (1824-1855)

(Publication No. 14,755)

Norman Owens Whitehurst Adams, Jr., Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Mark Eccles

My first aim in this thesis has been to determine the nature and extent of Byron's influence on the major and minor English poets writing from 1824 to 1855. The five major writers considered in this study are Tennyson, the Brownings, Clough, and Arnold. Since there followed after Byron's death a large number of Slavish imitators, I have chosen to limit my research to representative minor poets. The eleven selected are Emily Bront  , Letitia Landon, Felicia Hemans, Caroline Norton, J. Edmund Reade, Winthrop Praed, Edward Bulwer-Lytton, Philip James Bailey, Alexander Smith, Sidney Dobell, and William E. Aytoun. My second objective has been to demonstrate evidences whenever they appear of a deviation from or a rejection of Byron's influence, seeking at the same time an explanation for such differences.

In order to conduct a comprehensive and coherent study of this problem I elected to examine the poetry of each author in the light of six themes basic to the thought and expression in Byron's poems and dramas. These themes recur to a greater or less degree, depending on the individual artist, in the poetry published during the thirty years after Byron's death. The themes selected for examination are the Byronic hero, aspiration, passion and sentiment, Satanism, social consciousness, and satire. A single chapter is devoted to each of these six streams of influence. My procedure has been to consider first Byron's development of a particular theme and then to compare and contrast his treatment of it with the interpretations rendered in the poetry of the early Victorians. The seventh and final chapter is devoted to my conclusions.

It is clear, I believe, on the basis of the evidence presented in my thesis, that all the major writers, though Arnold to a lesser degree, underwent a period of literary

apprenticeship to Byron. All of them felt in some measure his influence while they were still in the formative stages of their careers.

Byron's influence on the mature poetry of the major writers was both positive and negative in its results. In those instances in which it was salutary, it was usually of an indirect nature. An exception would have to be made for Elizabeth Barrett Browning, whose temperament was so closely akin to Byron's that his influence whether direct or indirect tended to reinforce rather than restrain her emotional bent. By indirect influence I mean that the individual poet possesses sufficient creative ability to adapt a particular theme to his own literary purpose, the result being a variation on the original theme. Nor was it the personality of the poet alone which accounted for the change. The age itself demanded to be heard - an age vastly different from the one in which Byron had lived. Tennyson's conservatism, Elizabeth Browning's piety, Robert Browning's optimism, Arnold's morality, and Clough's compliance are representative attitudes of the Victorian age.

Conversely, when one of these poets yielded to mere literary convention in his use of a particular theme, the result was detrimental to his poetry.

As for the poetry of the minor writers, I find that Byron's influence was for the most part negative in value. The two themes which were most congenial to their poetic tastes were the Byronic hero and passion and sentiment. These they sought to incorporate in their poetry and at the same time to conform them to the ethical standards of a morally self-conscious society. By yielding to both Byronism and the demands of their own age, these minor writers produced a poetry which simply sentimentalized Romanticism. Unlike the major poets, they lacked the ability to use their Byronic legacy productively.

268 pages. \$3.35. Mic 56-529

THE LANGUAGE IN THE PLAYS OF JOHN MARSTON

(Publication No. 15,485)

John Martin Crotty, Ph.D.
University of Notre Dame, 1955

The language in the plays of John Marston has occasioned much comment, criticism, and even ridicule. But all this has been of the random sort. This study advances a theory that the underlying and guiding principle to the understanding of what is good, as well as what is bizarre, in the dialogue of his plays, is Marston's lively interest in the play as a special form of art. He shared with his contemporaries, in this Golden Period of the English Stage, an avid preoccupation with the delights of the theatre. And, like his contemporaries, he had thoughts of developing the technique of the stage. Part of this general desire to advance the craft of the playwright was an interest on Marston's part in creating a dialogue especially for dramatic expression.

Marston was part of a general reaction in literature which marked the transition from the Elizabethan to the Jacobean period. The Jacobean, in general, were critical of patterns of speech developed by Lyly, Spenser, Sidney,

and Marlowe, as well as the themes and interests of these authors and their imitators. They desired a more flexible handling of language, and a greater interest in the contemporary scene. Marston, in his plays, frequently satirized certain styles, and showed a desire to develop a language for the stage. He had a strong sense of theatre, and was very effective in his handling of stagecraft; consequently, it seems that in the composition of his dialogue, he was acutely aware of the stage situation. Although he may lose sight of general themes, and character development, he was effective in the individual scene. His dialogue was constructed to give the impression of a mind thinking or plotting, to depict a person momentarily disturbed or agitated, or to indicate general personality adjustment.

Marston was preoccupied with the importance of the contribution of dialogue in the total effect of the play. He used a singular cut of language in the speeches of his characters when relating past incidents, giving commands, or outlining future actions. He developed and used the satiric simile to give his dialogue a strong colloquial flavor and dramatic incisiveness. Finally, he employed such slight devices as interruptions in speech, and particles, with a consistency of purpose which shows that he wrote with an eye on the stage situation.

If the larger issues of tragedy and comedy eluded him, if characterization and the successful handling of themes and attitudes somewhat escaped him, his interest in stage business is nevertheless exacting and minute. It is his interest in creating effective theatre which makes Marston's approach to the drama unique; he grasped the full significance of its special form. He insisted that language must play its part in creating and communicating the reactions and the emotions of people in the situations and under the strains which occur in real life and must depict the activity and excitement of dramatic conflict. He regarded dialogue as perhaps the most important element contributing to the total effect of the play and strove to make it work in harmony with the settings, acting and stage business.

201 pages. \$2.51. Mic 56-530

THE POETRY OF HART CRANE

(Publication No. 15,515)

Lawrence Sanford Dembo, Ph.D.
Cornell University, 1955

The poetry of Hart Crane, which has generally been considered formless and eccentric, is, in reality, traditionally romantic. Like the early romantics, Crane envisioned a transcendental state that brought ultimate moral insight and ultimate awareness of beauty, and the emotion in his major poems is determined by the attainment of, or failure to attain, that ideal. What Crane called the "bright logic," "the imaged Word," or the "constant harmony," Shelley, for instance, might have called "Intellectual Beauty." Crane's mode of response, like Shelley's, was ecstatic declamation, and the vision he presented was only a vague neo-platonic ideal, rather than a precisely defined conception of experience. Despite its vagueness, however, the vision is coherent and

self-consistent. The source of confusion is Crane's language, not his theme, and once the reader becomes familiar with his idiosyncrasies of grammar and metaphor, the underlying form is reasonably clear.

From the beginning, Crane was concerned with reconciling the values of a materialistic society with those of the imagination; he believed that society without the poet lacked moral purpose and was unredeemed, and that the poet without society was a sterile clown. His first mature attempt to "reconcile irreconcilables" came in "For the Marriage of Faustus and Helen," in which he set forth the romantic vision of experience that was apparent in all his later poetry. With the aid of Nietzsche's description of the Dionysian view of life Crane tried to view both moral and physical destruction in the modern world as antecedent to the attainment of divine harmony. Similarly, in his quest for the "constant harmony" symbolized by Helen, the poet danced with Death, the "religious gunman," who in purifying him prepared him for the meeting with the goddess. Such a reconciliation of opposites did not really represent a compromise, for Crane was actually imposing on social experience a vision that had, at best, only psychological significance. It is one thing to say that the poet's personal suffering and psychological death is a purification that ends in ecstatic serenity; it is quite another to say that the whole world is undergoing that experience.

Only in such poems as *Voyages* is the Dionysian vision equal to the material it is intended to order: the poet-lover, in being destroyed by the sea, is reborn and granted a beatific vision of the "loured goddess." But in *The Bridge*, his major poem, Crane tried to generalize the experience of the voyager into that of the American people. The symbol of the Bridge supposedly represents a reconciliation of the machine and the imagination, but Crane really looked upon it as a "Tall Vision-of-the-Voyage" that one had to "die to understand."

At every critical point in *The Bridge* Crane's reaffirmation of faith was not in the greatness of America, but in that of the loured goddess of the imagination, who invariably appeared after the poet had suffered. The later poems indicate sufficiently that the "power-in-repose" represented by the Bridge could be manifested just as easily in tropical and other non-social objects without any of the moral strain that accompanied it in modern New York. Ironically, Crane's goddess of beauty and creativity was really the goddess of death, and his quest for the "spiritual essence" of life ended only in annihilation.

229 pages. \$2.86. Mic 56-531

THE WORLD VIEW OF WILLIAM FAULKNER

(Publication No. 15,453)

Frank Mitchell Hoadley, Ph.D.
The University of Oklahoma, 1955

In 1950, William Faulkner was awarded the Nobel Prize for literature. In his acceptance speech for this award, Faulkner clearly stated his broad faith in humanity. "I believe," he said, "that man will not merely endure: he will prevail. He is immortal, not because he alone among creatures has an inexhaustible voice but because he has a

soul, a spirit capable of compassion and sacrifice and endurance." To the casual reader of Faulkner's works this speech may seem somewhat inconsistent with his fiction. A close examination of his fiction reveals, however, a gradual shift from a pessimistic world view to one of limited optimism. His seventeen novels fall roughly into three periods: in the early period man is doomed and damned; in the middle period he merely endures; and in the final period Faulkner affirms that he will prevail. The purpose of this dissertation is to trace the development and movement of this changing world view.

Although Faulkner is considered a regional writer by most critics, the reader must have an understanding of the universal elements inherent in the Yoknapatawpha myth. Within the myth, the South labors under the twin curses of slavery and exploitation of the land. The present generation, corrupted by the amorality of modernism, is unable to identify itself with its cultural heritage. Unwilling to accept its moral responsibility, this generation withdraws into a suicidal pessimism and, abjuring its ethical traditions, views the degenerate state of mankind with detached irony. The few characters who retain the old values of "courage and honor and hope and pride and compassion and pity and sacrifice" are so vitiated by the curse that they are easy prey to the ruthless advance of the machine age and its attendant robots.

The ability to endure is first evident among the Negroes and poor whites. The Negroes, persecuted and exploited, have salvaged the old values and beliefs and escaped the time-compulsiveness of modern man. The poor whites, who must struggle to glean an existence from the stubborn earth, have somehow, by their contact with the land, escaped the futility of the planter-aristocrats. In *Go Down, Moses*, the land assumes almost mystical proportions in reclaiming man from his lost state.

The theme of atonement gradually emerges as a positive force in Faulkner's world view. If he would attain salvation, man must expiate through his suffering not only his own sins but also the inherited sins of the past, the responsibility for which he shares with his forefathers. This is the hard lesson that Temple Drake learns in *Requiem for a Nun*.

Finally, human and spiritual love become the forces which will elevate man above the animal and differentiate him from the machine. Only when man eliminates his racial bigotry and establishes universal brotherhood will the curse be lifted. In his final novel, *A Fable*, which treats the second incarnation of Christ, man is given the opportunity to fulfill himself through spiritual affirmation. The irony, however, persists, for rather than avail himself of this opportunity, man lends moral support to the second crucifixion. Yet this irony is mitigated by the fact that the crucifixion is an ambivalent symbol, superficially pessimistic, but within the context of the Christian myth completely optimistic. Christ dies that man may attain salvation. Man is no longer as in the earlier novels, the victim of a cosmic joke, a pawn moved about by the malignant Player. He is a free moral agent with the potential of reclaiming his lost dignity. Faulkner's future novels may well chronicle the way in which man exercises this potential.

327 pages. \$4.09. Mic 56-532

THE ARTISTIC WORLD OF
PAUL CLAUDEL

(Publication No. 15,636)

Marie Marthe Lavallée, Ph.D.
Columbia University, 1955

With Rimbaud, Claudel found an esthetic fulfillment completed in his sudden conversion to Catholicism. The conflict between his artistic goals and his Christian duties ended in the synthesis of religion and poetry. His esthetic theory is predicated on man's role as spokesman for the universe in recognizing creation's origin and sole function, that of testimony to its Creator.

Sharing in God's creative power, the poet seizes all existence and transforms it into a significant whole. The universe is the object of poetry, the word is the poet's text. In uttering the word, he presents anew the essence of being, spiritualizes reality and immortalizes it, investing it with mystic significance. The metaphor is the new tool of logic and the symbol becomes a function of reality by virtue of objects' co-existence. The tree is man, struggling upwards from matter to spirit. Water, in all its protean forms, is the unifying element in the world; in man, it is the soul, the fecundating principle of grace. It is infinity and eternity. Light is the mode of the soul and the activity of life. The earth and its fruits are the goodness of God's bounty, for all material reality testifies to what it is not in itself. Woman symbolizes divine grace, the unattainable, the temptation of mankind and his salvation.

Claudel's composition draws freely on all traditional forms, but his dictum that good is the composing principle in art is his primary rule and governs his broad use of all means to impose his works on the readers' attention. Claudel's lines are free in syllabic count. He attempts to find the inner rules of the word, its iambic beat, the suggestive accent of groups and rhythm, coupled with sonorous qualities, to create a poetic line representative of human breath. His language is vigorous, his use of syntax free and his style vital and tumultuous. He strives to integrate the blank into the poem, thereby involving the whole of existence in the single poem and in this fusion achieving the absolute poem within the particular.

The total poem transcends limitations of time, space and form. The frontiers between dramatic and lyric poetry are voluntarily transgressed, the lyric through the vast network of symbols and the dramatic through transformation into an epic parable of all mankind. The unseen protagonist is God to whom all Claudel's heroes must eventually succumb. Claudel seeks to integrate all the arts, particularly in his drama, using their techniques and vocabulary.

The mission of art is divine, with moral implications. Though he wishes to satisfy his own yearnings through art, Claudel is aware of his role as witness before God and men of the essence of reality, shown him by the faith he has embraced. Nature is a summons to men, and art recreates it as a significant, unified and intensified creation dependent upon another eternal, supernatural reality.

330 pages. \$4.13. Mic 56-533

AN EDITION OF FRAY HERNANDO DE
TALAVERA'S TRACTADO PROUECHOSO QUE
DEMUESTRA COMMO EN EL UESTIR Y
CALCAR COMUNMENTE SE COMETEN
MUCHOS PECCADOS Y AUN TANBIEN
EN EL COMER Y BEUER

(Publication No. 14,728)

Hannah Marie Nyholm, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Lloyd A. Kasten

As a consequence of the ostentation and excess so characteristic of Henry IV's reign ordinances were passed in an attempt to curb the frivolity of the people. Fray Hernando de Talavera's treatise on the sins that man commits in connection with two of his basic needs for self-preservation—food and clothing—is a defense of one such positive human law. The author wrote this work in 1477 while prior of the monastery of Santa Maria de Prado, outside the walls of Valladolid. Later he served as confessor to Queen Isabel and as bishop of Avila. After 1492 he became the first archbishop of Granada.

The text, here presented, is mentioned in Julian Zarco Cueva's *Catálogo de los manuscritos castellanos de la biblioteca de el Escorial* (Madrid, 1926), Vol. I. Though a shorter version has been published in *Escritores místicos españoles* (Nueva biblioteca de autores españoles, Vol. 16) and short excerpts are found in several books, the original text of 1477 has never been edited in its entirety, nor has a study of its sources been made anywhere.

The text is presented with variants taken from a later, shorter printed version, apparently revised by the author himself. A detailed study is made of Talavera's sources which are completely religious in nature, including as they do only references to the Bible and to ecclesiastic writers.

The treatise, since it is primarily a defense of an ordinance -- one forbidding women to wear "uerdugos y trajes de caderas," men "camisas con cabeçones labrados," and tailors the right to make such garments -- has been studied from two points of view: 1) The notion of law in the fifteenth century as reflected in Talavera's work. It is found to be clearly in the tradition of St. Isidore of Seville and St. Thomas Aquinas. 2) Anti-feminism in the fifteenth century. The principal contribution of this study to Spanish literature is probably in connection with the latter point. None of the previous students of Spanish anti-feminism refer to Talavera and it is not likely that they had first-hand knowledge of him. Though they refer to the Bible and the church fathers in their discussions of sources, it is obvious that no serious consideration has been given to the importance of the religious impact on man's attitude toward women as it is reflected in fifteenth-century literature. The study does not pretend to treat this influence exhaustively. Nevertheless, by means of a detailed source study, and through the introductory chapters evidence is submitted which points to the fact that some of the anti-feminism in the fifteenth century had its origin in the Bible and in such ecclesiastic writers as St. Jerome, St. Ciprian, St. Chrysostom and St. Thomas Aquinas.

277 pages. \$3.46. Mic 56-534

THE DRAMATURGY OF SEAN O'CASEY

(Publication No. 14,775)

Margaret Catherine O'Riley, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Paul Fulcher

This dissertation examines all the plays of the contemporary Irish playwright, Sean O'Casey. The aims are to determine what sort of development or change is apparent in his work; to arrive at some conclusion about his use of certain techniques often casually referred to as realism, expressionism, or impressionism; to show at what point and in what way O'Casey became a vital part of the Irish Dramatic Movement; to show what is his special contribution; and, finally, to make clear his position among Irish dramatists of the twentieth century.

A brief sketch of O'Casey's early life in Ireland is given to establish the background material which he used to create many of his characters and plots. Enough of the history of the Irish Dramatic Movement is related to show at what point O'Casey became a part of it.

The plays, from The Shadow of a Gunman through The Bishop's Bonfire, are discussed in the order in which they were written. Descriptions of the production and reception of each play illustrate contemporary opinion of O'Casey's work. The particular dramaturgic skill of each piece is considered by analyzing such elements as technique, characterization, symbolism, theme, and language.

This study shows that Sean O'Casey is not and never was the photographic realist which some critics have considered him to be. In his earliest plays there was a strong tendency to make his characters, not absolutely real, but larger than life as viewed through the imaginative mind of the artist. O'Casey did not write three realistic masterpieces and then lose his way. His development has been steady and sure. In technique he has moved from realism to expressionism to symbolism. All these methods he has combined with a great deal of success. He has never lost sight of the importance of characterization. From first to last he has depicted character through the medium of poetic words that have rightfully earned him the name "Lord of Language."

Sean O'Casey has written plays that rank with the best of those in the twentieth century; he has helped to free drama from the chains of dramatic realism. A brief consideration of what other significant Irish dramatists have done, including Lennox Robinson, Denis Johnston, George Shiels, and Paul Vincent Carroll, proves that O'Casey has merited the title accorded him by his friend and critic, George Jean Nathan, "The Best of the Irish."

480 pages. \$6.00. Mic 56-535

THE GRACIOSO OF SIGNIFICANT NAME
IN THE THEATRE OF JUAN RUIZ
DE ALARCÓN Y MENDOZA

(Publication No. 14,994)

Alice M. Pollin, Ph.D.
New York University, 1955

Adviser: Professor Joaquín Casaldueiro

This study first reviews the treatment given the presentation, in drama, of the comic in general and the comic servant in particular by selected critics of the nineteenth and twentieth centuries. A detailed analysis is then made of the functions and significance of the symbolically-named graciosos in nine plays of Ruiz de Alarcón. The conclusion summarizes and correlates the themes thereby suggested, along with corresponding themes in his other plays.

Attention is directed to those critics who have concerned themselves with the special nationalistic, subjective, and psychological phenomena which Alarcón's gracioso purportedly demonstrates. In the comedias analyzed, however, he is viewed rather as an artistically and structurally related component of Alarcón's comedias, one of the many voices of the polytonal composition in the Baroque style. The gracioso is studied with regard to such problems as reality, ideality, salvation, revelation, truth, wisdom, and reason. Stress is laid not only upon his relationship to the galán and other important personages, but also upon the pervasiveness of his functioning—by anticipation, complement, parallel, contrast, or reflection—in the dominant strains of the comedia.

Zaratán, the gracioso of La crueldad por el honor, is symbolic by his name, physical and moral attributes, and dramatic function, of the disease ravaging the body politic. Agüero, sharing the stage as comic figure and symbol with Jimeno (La industria y la suerte), signifies, by the mode of his inclusion in the comedy and his appellation, the theme and the limits of destiny in ruling the lives of men. He also reflects many other important currents, such as the money-motive. Salomón and Pimienta likewise complement each other as clown and symbol, respectively, in the important moral and religious aspects of La manganilla de Melilla. Ganar amigos, comedia of social merits and virtues, includes the worthy gracioso Encinas, as stalwart and unimpeachable as his name, while Ochavo's worth (El examen de maridos) is indicated by his mode of speech and conduct as well as by his name. Campana's absurdity, chiefly consequent upon his unflinching pursuit of the wrong course of action, stems from his clumsy attempts to realize ideal values in the real world. These attempts create the complications as well as most of the humor of Los empeños de un engaño. Redondo's name and modus operandi symbolize his course of action and the wheel of fortune in the vicissitudes of love in Mudarse por mejorarse. The famelic, timorous figure of Cuaresma stalks his comic and symbolic way through Los pechos privilegiados, underscoring the sensuality and moral degradation of the king, the gracioso being contrasted with the ennobled Jimena, who has become infused with the strength and virtue of her aristocratic charge. El tejedor de Segovia presents a gracioso, Chichón, whose very human frailty—physical and moral—puts into sharper focus the superhuman strength and courage of the "weaver", a noble in disguise, as he

threads his way to salvation and the vindication of his noble heritage.

Alarcón's theatre reflects a microcosmos in which man's heroism and dignity emerge as the constant victors. Truly noble moral dignity flourishes best on the elevated plane inhabited by those endowed with the idealism, will, and fortitude to prevail over the opposing forces of evil found both in nature and in society. In his portrayal of *la condition humaine*, Alarcón generally, but with exceptions, relegates the *gracioso* to the status of man in his lower scale of development; therein lies the essence of his comic aspect. The *graciosos* represent the almost complete gamut of man's propensities and foibles, but the weaknesses they display are not their exclusive property. Usually, the *figura del donaire* is a sympathetically vibrating instrument, consonant with the dominant themes of which the *comedia* is composed.

246 pages. \$3.08. Mic 56-536

HENRY JAMES AND FRENCH NATURALISM

(Publication No. 14,664)

Lyall Harris Powers, Ph.D.
Indiana University, 1955

There was an inevitability in James's moving, in 1875, to Paris and, via Turgenev, into contact with Flaubert's circle—Goncourt, Daudet, Zola, Maupassant, whence arose the French Naturalist school. James's critical writings, 1865-75, show he shared the interests of the Naturalist group.

The ideas of the Flaubert circle grew out of the *zeitgeist* of *le scientisme*, and more immediately from the writings of Comte, Taine, Balzac. They embraced the scientific method: observation, objectivity, freedom from "moral" consideration, reliance on "facts"; Zola particularly employed the results of research on heredity and environment, and the conception of determinism, and formulated his theory of the *roman expérimental*. By 1880 French Naturalism was enjoying a vogue in France. James's comments on the Flaubert circle (especially on Zola) reveal his continuing interest in the movement; by 1884, his own literary position was running closely parallel to it. "The Art of Fiction," emphasizing artistic freedom, reliance on factual observation, and the aim of "representing life," or creating the "illusion of reality," marks the beginning of James's experiments in the Naturalist genre.

James's three novels (and many of the tales) of the eighties give evidence of such an experiment. The descriptions in *The Bostonians* and *The Princess Casamassima* recall Balzac and Zola. Not only has James here "done" Boston, Cambridge, New York, and London in the Naturalist tradition; he also provides "settings" for his characters which define and explain them. The method of *The Tragic Muse* recalls the "selective" descriptions of Flaubert and Maupassant; and there James "does" Paris and London and the institution of the theater, and creates a Balzacian *scène de la vie politique*.

James's efforts to achieve objectivity, to remove the omniscient author from stage-center, are an interesting development from the Naturalist practices. Besides the

variations on first person narration, found in many tales of this period, he develops the device of "focussing" characters through whose eyes the story is presented. The story thus seems to tell itself. Various phraseological artifices aid in creating this illusion, as does James's dramatic talent in the scenes of straight dialogue. And these writings are singularly free of author's interpretive comment.

In the three novels of the eighties the forces of heredity and environment are given important roles in determining the fate of the characters involved. A difference in James's *roman expérimental* is that he is as interested in the character's awareness of the hereditary and environmental factors as in their determining force. It is this difference, this interest, that foreshadows James's major phase, when his interest concerns itself entirely with the character's awareness—particularly in *The Ambassadors*, which is the story of Strether's awareness, of his consciousness.

The narrative techniques employed to circumvent the omniscient author—the variations of primal narration and the focussing devices—likewise prepare for the novels of the major phase. The experiment of the dramatic years also contributed to James's final style—"the dramatization of a consciousness." The dramatic and the Naturalist experiments were supremely important in developing James's final style. 321 pages. \$4.01. Mic 56-537

A CRITICAL AND ANNOTATED EDITION OF LOPE DE VEGA'S *EL VILLANO EN SU RINCON*

(Publication No. 14,739)

Douglas Claire Sheppard, Ph.D.
The University of Wisconsin, 1955

Supervisor: Associate Professor Everett W. Hesse

Despite the several imitations which it inspired and the high praise accorded it by no less a discerning person than Baltasar Gracián, Lope de Vega's play *El villano en su rincón* was scarcely mentioned by the critics in Spain throughout the nineteenth century. Within the past twenty-five years, however, *El villano* has enjoyed remarkable success on the stage and is still being presented regularly at the *Teatro Español* in Madrid. One of Lope's more recent biographers esteems the classic style and prodigious aesthetic equilibrium. Another eminent Spanish scholar equates the play with *Peribáñez* and *El caballero de Olmedo*, referring to it as the *comedia* in which Lope's philosophic commentaries are best combined. Such encomium notwithstanding, the play still awaits the attention which it merits.

Although *El villano en su rincón* has been edited at least eight times since its first printing in the *Séptima parte* of 1617, it has never previously been treated in more than semi-critical fashion; hence, the present edition.

For want of an autograph manuscript, the text transcribed is that of the first edition. Except for the modernization of punctuation, capitalization, and accentuation

—capricious and all but nonexistent in the *Siglo de oro*—the original readings have been scrupulously maintained in all instances where they could in any wise be justified. The variant readings of the *princeps* and/or succeeding editions have been recorded.

The edition is preceded by a critical introduction outlining the history of the play in the printed versions, on the stage, and among the critics. Sources have been traced, the influence of the theme upon later playwrights noted, and the essential details of plot presented in a synopsis. A section is devoted to the versification; another to notes elucidating unusual terminology or allusions and relating these examples to similar usage in Lope's writings as well as in other works of the period.

As to style, theme, and philosophy, *El villano en su rincón* is reminiscent of many other plays by Lope, but the peasant versus nobleman motif, the defense of monarchy ideology, and the well-planned composition bring to mind most readily *Peribáñez* and *Fuenteovejuna*. In one respect, the play may be classified as a *comedia de costumbres rurales* with Lope's special genius for dramatizing the Spanish rural ambient reaching new heights in the splendid characterizations, charming songs and dances, rustic customs, and wide range of lyric passages.

But there is an aspect of greater significance involving Juan Labrador, the "King in His Own Corner," who believes that to live honestly and honorably in one's sylvan retreat is far more desirable than to be corrupted by the artificial milieu at court. In his abiding contempt for courtiers, Juan offends the King and, willy-nilly, is brought to court through a series of circumstances which, for the protagonist at least, border on the miraculous.

Thus, Lope manages to superimpose upon his *comedia de costumbres rurales* a *comedia filosófica* with overtones of the *auto sacramental* a *lo profano* in which the seventeenth century philosophy of social integration is set off against its antithesis of earlier times, not only in the thematic defense of monarchy, but also in the several motives with their references to Horace, Fray Luis de León, Garcilaso de la Vega, and Antonio de Guevara. All the nuances add up to a dramatic allegory of unusually subtle stylistic complexity in which there is entertainment for an audience at any level of discernment. How Lope accomplished this integration without destroying the verve and seeming spontaneity of the play is discussed in the stylistic analysis and evaluation of the introduction.

275 pages. \$3.44. Mic 56-538

THE RELIGIOUS AND MORAL PHILOSOPHY OF SIR WALTER SCOTT

(Publication No. 15,274)

James Erwin Smythe, Ph.D.
University of Illinois, 1955

This analysis of Scott's religious and moral principles is justified by Lockhart's statement that he had neglected to treat such principles in his life of Scott and by the present confusion concerning Scott's religious and moral views. It should be noted that Scott discussed the religious faith of the subjects of all of his biographies.

By analyzing chronologically his attitude toward the

Church of Rome, this thesis shows that Scott consistently opposed the Roman faith but at the same time respected those who held it through sincere conviction. This study indicates that he advocated Catholic emancipation as a political issue and that his interest in Catholic ritual, hymns, and architecture was purely artistic. He influenced the Oxford Movement by treating the Middle Ages in his works and by treating the Roman Church more moderately than did many of his contemporaries, but he did not advocate a return to the Middle Ages nor did he intend to aid the Tractarians.

By an historical analysis of the English and Scottish churches in Scott's works, this study shows that Scott had no partiality for either communion but opposed the extreme element in each. He felt that each church was well suited for the country in which it originated. For these two churches in his own day he had very little criticism. His preference, however, seemed to have been for the Moderate branch of the Scottish Kirk. A chronological analysis of his relations to these two churches indicates that he likely never left the Presbyterian faith of his fathers, for he distrusted religious turncoats. Because his wife and most of his children were Anglicans, he did use the English service in the family devotions, but he retained a nostalgic devotion for the simple Scottish form of worship.

This study presents Scott's faith in the fundamental Christian views of God, Christ, the supernatural, the nature of man, predestination, the eucharist, the judgment, rewards and punishment, immortality, and the inspiration of the Bible. His faith in these doctrines was not merely conventional but arose from a sincere faith in the Christian religion and thorough understanding of each doctrine. Nevertheless, he considered the value of the doctrines to be the moral effect that they have on those who believe them.

This thesis also proves that Scott was a thorough moralist, concerned with the great moral value to be derived from history, biography, and literature. In his criticism he consistently condemned all that he believed to be detrimental to morality, and he attempted to keep his own works free from moral offense. From time to time he paused to condemn such vices as intemperance, lust, pride, anger, envy, covetousness, and indolence and to praise such virtues as industry, fortitude, duty, faithfulness, sincerity, honesty, and selflessness. He attempted to keep his own life free of these vices and to incorporate these virtues into his relations with his fellowman, for he felt that man's greatest moral obligation consists in loving his neighbor as himself. Scott was one who loved his fellowman—whether he was relative, friend, aristocrat, peasant, king, servant, neighbor, or fellow poet, and all these returned the affection that he gave them.

Finally this study shows that Scott's attitudes toward the Medieval church, moderation, man, violence, and negative capability influenced his political views concerning the Hanoverians, progress, political moderation, individual liberty, reform, individual benevolence, and national morality.

All in all Scott's religious and moral philosophy was sincere and well-organized, and its influence is seen not only in his life but in the highly religious and moral character of his works. 426 pages. \$5.33. Mic 56-539

WILLIAM DEAN HOWELLS: THE OHIO
YEARS IN HIS NOVELS

(Publication No. 15,275)

Benjamin Aaron Sokoloff, Ph.D.
University of Illinois, 1955

My method in this study is to go back to crucial determinations in William Dean Howells' Ohio background, study each one separately, and then come forward to show its direct or indirect reappearance in Howells' fiction. By 1861, the year Howells left Ohio and the United States, his mind and his view of art—its purpose and morality—were so formed that there were few changes later. Howells and his place in American literature cannot, therefore, be understood unless one has a thorough knowledge of his Ohio years (1837-61), the most important years of his life.

Howells learned from his family, and particularly his father, the values that characterize him as a man and as a novelist. From his father and his family he learned love, compassion, charity, and the humanity which are seen in his novels from *Annie Kilburn* to *A Traveler from Altruria*. The elder man's Quakerism and Swedenborgianism account for a great deal in the life and art of his son, and his strong interest in utopian projects helped prepare William Dean for his Christian socialism and for the results of this belief in his Shaker, economic, and utopian novels. The father's literary bent, his insistence that all his sons work in the printing-office, and the encouragement he gave Howells' early writing efforts were central to the son's literary career.

The Ohio ante-bellum village supplied Howells with what was to be the most vital theme in all his work—the idea of social and economic equality. Its example of agrarian simplicity and genuine brotherhood was to remain in his mind forever, and the village itself was to become a model for the ideal community, Altruria.

In the village printing-office Howells began his first labor with words; he wrote poems, sketches, and stories by immediately setting them in type. The step from printing to journalism was an easy one to make, and journalism became the way to his highest ideal, pure literature. As observer-reporter he became a spectator, a role he was to maintain as novelist. In his later books Howells reflected his own journalistic activity, his literary aspirations of that time, and fragments of the youth that he was. In his fiction he also discussed the ethics of journalism and pondered on the new race of newspapermen who were the practitioners of that yellow journalism so foreign and distasteful to Howells and to the men of his generation.

Howells' practice of realism began very early in those journalistic sketches and stories; he was a "realist" before he knew the term. Although his realism was private, selective, and genteel and even though there was much in life he could not bear to write about, yet he could write honestly, even brilliantly, of our social and economic inequalities. He showed us the economic chance world of the late nineteenth-century in America and the rise of the titanic, malevolent city with the accompanying decline of the rural village. His studies in the degeneration of individual character were also highly astute. In all, his achievement in realism is quite considerable in spite of his temperamental overfastidiousness and exaggerated sense of propriety.

The basic flaw in Howells has been attributed to the influence of Boston, his almost feminine nature, his sexual timidity, and his misunderstanding of economic forces. He did have an abhorrence of extremes and a fear of brutality in life. He saw evil but could not gaze on it long; he simply could not express the evil which is so vital a part of living. Some partial explanation of his timidity may be obtained when we realize that much of his childhood and youth was spent in sickness, real and imagined. He suffered from homesickness, hydrophobia, severe headaches, vertigo, melancholia, and a fear of death; all these ills were spread over the early years and some of them, such as hydrophobia and the fear of death, lasted for very long periods of time. His psychological breakdown at twenty suggests that he had a neurosis, that most of his ills were of psychosomatic origin. His complete recovery by 1865 destroys the idea that his literary performance was vitiated by a neurotic hangover from his youth. Yet the basic cause or causes of his psychological difficulties persisted in attenuated form and are probably at the root of his mature reticence to deal with the sordid facets of life. But it is not correct to say that he was a life-long neurotic: Howells' reservations in the novel were also due to the taste and mores of his age and to the fact that women were the vast majority of the reading public.

Howells' relative failure, his inability to write a truly great novel, was a result of his humanly natural self-evasion. He could not admit the truth about himself to himself; he did not write the novels he wanted to write. Never did he write the novel of the Ohio village that he wished to do; never did he succeed in writing the epic of New York or the novel showing "the hideous face of industrialism." But his achievement must not be underestimated; he wrote seven or eight novels of major significance, and he did prophesy the direction of the modern American novel. 219 pages. \$2.74. Mic 56-540

PICTORIAL METHOD IN
THE NOVELS OF HENRY JAMES

(Publication No. 13,733)

Henry Larkin Terrie, Jr., Ph.D.
Princeton University, 1955

Painting and the drama are generally recognized as crucially important in the life and art of Henry James, and much has been written concerning the effect of the drama on his fiction. Little has been done with the effect of painting. This study attempts to show, first, that James had a remarkably visual imagination and, second, that he used it to achieve significant pictorial effects in his novels.

The first chapter is a study of James's pictorial imagination, based on the evidence of his writings and his life. From early childhood he was exposed to the great art galleries in Europe and America, and he went so far in appreciation as to aspire to a painting career himself. When he left painting for writing, he carried with him ideas and methods acquired in studio and gallery: he tended to see the world around him in terms of

colors and compositions; he constantly looked for pictorial effects in the writings of others; and his own writing, both fiction and non-fiction, is marked by a persistent effort at pictorial creation.

Two chapters are devoted to demonstrating James's systematic use of his pictorial imagination in conceiving and writing his novels. In the Prefaces he speaks repeatedly of "visualizing" his characters and settings before beginning to write and tells us that he habitually stimulated his visual imagination by exercising his physical eyesight. When he wrote, James conscientiously attempted to convey his own mental pictures to the reader. It was his contention that the responsible writer always has a "duty" to make his prose "bristle" with visible presences.

My study concludes with four chapters on major aspects of the pictorial method: "Point of View," "Picture and Drama," "Economy," and "Composition."

The consistently maintained point of view, by means of "concentrated individual notation," gives James's pictures the vitality of felt observation. In the "picture-drama" opposition, picture (the descriptive and narrative part of the story) prepares the way for the fully dramatized scene by giving the reader a visual sense of characters and settings. And in the final analysis, picture and drama interact so that each enhances the quality of the other.

Ideally James would have liked to dramatize (render completely) every action in his story, but obvious limitations of space make this impossible. Rather than simply ask the reader to take undramatized action "on trust," however, he relied on certain economic devices to give the illusion of completeness: functional treatment of antecedent action, the use of one scene to do the work of two, the use of moments of revelation to summarize action, the use of extended images to suggest a process or a passage of time, and a very compact rendering of minor details to give the effect without the substance of full dramatization. All these devices add to the completeness and vividness of James's pictures.

And finally, in addition to creating page by page visibility, James composed his novels to make a single unified picture. He gave each novel a compositional center which serves as a focal point for the eye, and he "framed" his picture by including only action functionally related to the compositional center.

Examination reveals that in every way James's late novels (those after 1896) are more pictorial than his early ones, the three supreme "pictures" being *The Ambassadors*, *The Wings of the Dove*, and *The Golden Bowl*. The pictorial method is a highly significant aspect of James's creative process since it was one of his principal means for rendering that "direct impression of life" which, he felt, constitutes the value of a work of art.

199 pages. \$2.49. Mic 56-541

THE CRITICAL REPUTATION OF RESTORATION COMEDY IN MODERN TIMES

(Publication No. 14,784)

Steven John Van Der Weele, Ph.D.
The University of Wisconsin, 1955

Until the closing decades of the nineteenth century, Restoration Comedy, with a few exceptions, had not received due recognition. In this dissertation I present the substance of recent criticism expressed about this comedy, showing that despite an occasional vigorous and spirited protest, the trend of opinion has been to endorse the achievement of this literature.

Part I, after furnishing a history of Restoration comedy in the seventeenth century and an account of the Collier controversy, presents critical opinion of the eighteenth and nineteenth centuries. Except for an occasional affirmation of the essential soundness of this comedy and of its continuity with the comic tradition in western civilization, the eighteenth century either censured it for its immorality or praised it in general terms. In the nineteenth century, both favorable and unfavorable opinion was expressed more fully, and the tone of the criticism became more polemical.

Part II deals with comment expressed in modern times about Restoration comedy treated as a unit. In the first chapter I present the judgments of this literature which appear in histories of literature and of drama. The value of this material varies widely. At its best it regards this literature sympathetically and with acuity. In the second chapter I present the methods used respectively by Palmer, Dobrée, and Perry to interpret this literature. Palmer's book examines it in terms of manners, Dobrée's --the most satisfactory of the three--examines it impressionistically, Perry in terms of the comic spirit as defined by Meredith. In the next three chapters I discuss materials in which Restoration comedy is compared with other units of drama: comedy of the Elizabethan and Jacobean period, sentimental comedy, and the comedy of Molière. Although Restoration comedy is not valued as highly as the comedy of earlier English writers and of Molière, it compares favorably with these units in important ways. Restoration comedy is almost invariably preferred to sentimental comedy for its greater realism and its greater fidelity to the comic tradition. Chapter six deals with miscellaneous comment--sanctions and protests. In this chapter I discuss such opinions as Stoll's, who contends that it is an error to regard Restoration comedy as a reflection of its age, and that this literature consists of conventions by which all art must abide; Ellehaug's--actually embarrassing for the reputation of Restoration comedy--that this literature is valuable for its daring protests against conventional morality; Strachey's, that what is most valuable in this literature is its distinctively English flavor; and Knight's, that since Restoration comedy fails aesthetically because of its essential triviality, the charge of immorality need not even be considered. Chapter seven examines the opinion of several critics, T. S. Eliot among them, that the seeming defiance of traditional morality in Restoration comedy presupposes a sound moral code, and that the Restoration writers present morality "by inversion." This chapter deals also extensively with Fujimura's recent study, *The Restoration Comedy of Wit*, a book which, in my opinion,

is more valuable for its emphasis on irony and wit in this comedy than for its general argument to the effect that this literature must be viewed as "a witty presentation of a naturalistic outlook on life."

Part III examines recent opinion expressed about the five major writers of Restoration comedy. Etherege emerges as the innovator of manners comedy, Wycherley as the heavy-handed satirist, Congreve as the greatest artist, Vanbrugh as an amateur without any settled point of view, and Farquhar as a dramatist who, though inferior to the others, extended the range of English comedy and injected new life into the stage.

771 pages. \$9.64. Mic 56-542

THE SHORT WORKS OF VIRGINIA WOOLF: A STUDY FOR THE ORAL INTERPRETER

(Publication No. 15,171)

Elizabeth Worrell, Ph.D.
Northwestern University, 1955

The purpose of the writer and of the oral interpreter of literature is directed toward the same goal: communication of thought and emotion. When the two arts are effectively combined, the result may be an enrichment, an intensification of experience. Virginia Stephen Woolf was deeply concerned with the problems of communication. Among her twenty-one published volumes are seven anthologies of essays and stories: Monday or Tuesday (1921), The Common Reader (1925), The Common Reader: Second Series (1932), The Death of the Moth (1942), A Haunted House (1944), The Moment (1947), and The Captain's Death Bed (1950). It has been the purpose of this dissertation to study the short works of Mrs. Woolf in order to perceive which of these works will be of the greatest interest to the oral interpreter; to aid the interpreter to remain true to the author's meaning and purpose by revealing the particular insights, attitudes, and skills manifested in these essays and stories.

Because of the personal nature of many of Mrs. Woolf's short works, attention has been given to her background, to the development of her art, and to her attitude toward literary criticism. Her own skill as a performer has been

noted, and examples have been given to demonstrate her interest in the oral aspects of literature.

Each of Mrs. Woolf's collections of short works was considered as a whole, and then a study was made of the individual pieces. Although the interpreter will be interested in all of her short works, some of them, by virtue of their subtle evocation of mood and personality, their pictorial quality, or their rich use of imagery and tone-color, will be of more immediate interest to the oral interpreter than those devoted primarily to a discussion of a theory of the art of writing.

Within the collections, the oral reader will find a wide variety of subjects from which to choose. Literature is an underlying theme in all of Mrs. Woolf's work. Other themes which characterize her writing are important and complicated, one inextricably interwoven with another: peace, harmony, understanding, and truth. These themes are supported by many, perhaps lesser, but in her mind, related ideas. She scorns all those who, from pride of profession, wealth, influence, race or sex, practice the art of dominating others. Man's desire to dominate stifles learning, invades the individual's right to privacy, deprives him of solitude necessary to creativity, impairs understanding, increases the difficulties of communication, and precipitates war and chaos.

Mrs. Woolf establishes an atmosphere of friendliness and intimacy by addressing herself to "the common reader," and placing herself in the same category. Her prose takes on the quality of conversation as she varies the length and rhythm of phrase to fit the thought, and asks frequent questions, leaving the reader to supply the answers, or to find a partial answer imbedded in a symbol or image. She implements her imagery with melodic effects of tone-colour and rhythm; these devices are often used for subtle touches of humor, or to convey intensity or thought or emotion. Frequent repetition of word and phrase provide a cumulative effect that sets up a rhythmical reverberation of sound and thought among all her works.

The complexity of theme, the intentional ambiguity of symbol, the intricacy of melodic effects, all present problems to the oral interpreter of Mrs. Woolf's short works. What she said of the silent reader applies to the oral interpreter as well: "...to read a book as it should be read calls for the rarest qualities of imagination, insight, and judgement...." 395 pages. \$4.94. Mic 56-543

PROBLEMS OF EXISTENCE AND STABILITY
OF SOLUTIONS OF DIFFERENTIAL SYSTEMS

(Publication No. 14,375)

Herbert Reeder Bailey, Ph.D.
Purdue University, 1955

Major Professor: Lamberto Cesari

In Part I we consider linear differential systems of the form

$$(1) \quad \ddot{y}_j + \sigma_j^2 y_j + \lambda \sum_{h=1}^n \varphi_{jh}(t) y_h = 0$$

where λ is a small real parameter, σ_j are positive constants, and $\varphi_{jh}(t)$ are periodic functions of period $T = \frac{2\pi}{\omega}$.

Under the condition that each $\varphi_{jh}(t)$ is of average zero and that each $\varphi_{jh}(t)$ admits an absolutely convergent Fourier series, L. Cesari has proved that

- * if either (a) $\varphi_{jh}(t) = \varphi_{jh}(-t)$, $j, h = 1, 2, \dots, n$ or
(b) $\varphi_{jh}(t) = \varphi_{hj}(t)$, $j, h = 1, 2, \dots, n$, then for $\sigma_j \neq \sigma_h \neq m\omega$ and $\sigma_j \neq \sigma_h$, $j \neq h$, $j, h = 1, 2, \dots, n$, $m=1, 2, \dots$ and for $|\lambda|$ sufficiently small, all solutions of (1) are bounded in $(-\infty, \infty)$.

Using a modification of the method of casting out secular terms used by L. Cesari, J. K. Hale has proved that the condition of the absolute convergence of the Fourier series of the functions $\varphi_{jh}(t)$ can be replaced by the condition that $\varphi_{jh}(t)$ are L-integrable on a period $[0, T]$. J. K. Hale and R. A. Gambill have proved that the condition that each $\varphi_{jh}(t)$ have average zero can be omitted. They obtained this result by transforming system (1) into another written in equivalent form where this condition is satisfied.

In the present paper we discuss linear differential systems more general than (1), namely, systems which for $\lambda = 0$ present characteristic roots some of which may be zero and not all on the imaginary axis as the characteristic roots $\pm i\sigma_j$ of system (1). More precisely, we will consider general systems where the characteristic roots may have non-positive real parts, some may be multiple of any multiplicity and some may be zero. This last case is particularly important since it is connected with problems of stability of periodic solutions of non-linear differential systems as discussed in Part II.

These results are obtained by using the method of casting out the secular terms used by L. Cesari, J. K. Hale and R. A. Gambill, in such a way that the case where the functions $\varphi_{jh}(t)$ have non-zero average is included. Both the method and its convergence are discussed according to the modification of J. K. Hale used in connection with non-linear systems. This discussion allows us to prove * directly without assuming that the $\varphi_{jh}(t)$ have average zero.

Some of these results are also obtained by another method closely related to the perturbation method of Poincaré.

Examples are considered of second order linear systems whose characteristic roots for $\lambda = 0$ are not all on the imaginary axis. For instance, systems of the type

$$\begin{aligned} y_1'' + a y_1' + \lambda \sum_{h=1}^3 \psi_{1h}(t) y_h &= 0 \\ (2) \quad y_2'' + c y_2' + d y_2 + \lambda \sum_{h=1}^3 \psi_{2h}(t) y_h &= 0 \\ y_3'' + e y_3 + \lambda \sum_{h=1}^3 \psi_{3h}(t) y_h &= 0 \end{aligned}$$

where the ψ_{jh} , $j, h = 1, 2, 3$ are periodic of period $T = \frac{2\pi}{\omega}$.

For particular values of the parameters and for particular functions $\psi_{jh}(t)$ we give cases where all solutions of (2) are bounded and cases where some solutions are unbounded, provided $|\lambda|$ is sufficiently small.

In Part II we consider second order non-linear differential systems of the form

$$(3) \quad \ddot{x}_i + \sigma_i^2 x_i = \epsilon f_i(x_1, \dot{x}_1, \dots, x_n, \dot{x}_n, t) \quad i = 1, 2, \dots, n,$$

where ϵ is a small real parameter, $\sigma_1, \dots, \sigma_n$ are real constants, f_i are real analytic functions of $x_1, x_2, \dots, x_n, \dot{x}_1, \dots, \dot{x}_n$ with coefficients period in t of period $\frac{2\pi}{\omega}$, and $\sigma_i = \frac{k_i}{m_i} \omega$ $i = 1, 2, \dots, n$.

J. K. Hale and R. A. Gambill have modified the casting out method discussed above and have obtained sufficient conditions for existence of period solutions of (3).

In the present Part II we obtain sufficient conditions that a periodic solution of (3) be asymptotically stable. We obtain these conditions by extending to systems of order n a remark of L. Mandelstam and N. Papalexi concerning one second order equation. We then review the method of L. Cesari, J. K. Hale and R. A. Gambill for determining conditions for existence of periodic solution of (3). In §4, 5 and 6 we consider particular examples of (3) and determine conditions for existence of periodic solutions by the method of L. Cesari, J. K. Hale and R. A. Gambill and then determine sufficient conditions for asymptotic stability of these periodic solutions.

For instance we consider, for $|\epsilon|$ sufficiently small, existence and stability of periodic solutions of

$$(4) \quad \ddot{x} + \sigma^2 x = \epsilon [A\dot{x} + Bx \cos 2\omega t + Cx^3 + Dx^2\dot{x} + Ex^3 \cos 2\omega t]$$

and

$$\begin{aligned} \ddot{x}_1 + 4x_1 &= \epsilon [A_1\dot{x}_1 + B_1\dot{x}_1 \sin 4t + C_1x_1x_2^2] \\ (5) \quad \ddot{x}_2 + x_2 &= \epsilon [A_2\dot{x}_2 + B_2\dot{x}_2 \sin 2t + C_2x_2x_1^2] \end{aligned}$$

Equation (4) generalizes the cases considered by N. Minorsky by his stroboscopic method, heuristic in character. Thus, we obtain, as particular cases, and by a rigorous method, results already indicated by N. Minorsky.

In §7 we determine sufficient conditions for Liapounoff stability of the solution $y = 0$ of the equation

$$(6) \quad \dot{y} + [a + p(t)] y = [c + q(t)] y^n$$

where $p(t)$ and $q(t)$ are periodic of the same period. Equation (6) which is of the Bernoulli type and thus can be integrated formally, occasions the application of some results of J. K. Hale. 139 pages. \$1.74. Mic 56-544

THE MODELING OF ZERMELO SET THEORIES IN NEW FOUNDATIONS

(Publication No. 15,587)

George Edwin Collins, Ph.D.
Cornell University, 1955

Let B be the theory of sets and classes which has the following non-logical axioms: Axiom of extensionality, unordered pair axiom, axioms insuring that every normal statement determines a class, axiom of infinity, sum set axiom, power set axiom, and Aussonderungsaxiom. Let BF be B plus the replacement axiom and let ZF be like BF except for the absence of classes. NF designates the system New Foundations. The problem considered is that of obtaining extensions NF_1 , NF_2 and NF_3 of NF which admit models respectively for B , BF and ZF .

The models are constructed by defining in NF a function G similar to the modeling function F used by Gödel in proving the consistency of the generalized continuum hypothesis relative to BF . Some of the values of G are taken as the sets of the models, and for B and BF , classes of the models are also values of G . The ϵ -relation of the model, ϵ_G , is not the ϵ -relation of NF but is defined inductively and simultaneously with G in such a manner that $\alpha \epsilon_G \beta$ is stratified when α and β have the same type. The arguments of G are unit classes or ordinals and its values are sets of ordinals. The function G was first exploited by C. D. Firestone and later by S. Orey in Cornell University theses.

After constructing G , it is shown that for NF_1 it suffices to add to NF an axiom asserting the existence of $\omega(\omega(0))$. (The notation $\omega(\theta)$ is used in place of ω_θ .) For NF_2 it suffices to add an axiom asserting the existence of an inaccessible ordinal.

It is shown that for NF_3 one may take any extension having a statement $Orn(\theta)$ satisfying (1) θ is the unique free variable of $Orn(\theta)$, (2) $\vdash Orn(\theta) \supset \theta \in NO$,

$$(3) \quad \vdash Orn(\theta) \cdot \phi < \theta \cdot \supset Orn(\phi),$$

(4) $\vdash Orn(\omega(0))$, (5) $\vdash Orn(\omega(\theta)) \supset Orn(\omega(\theta+1))$, and (6) any 1-1 statement whose arguments and values are in Orn and whose arguments are bounded in Orn has its values bounded in Orn also. It is not assumed that $Orn(\theta)$ is stratified, and (6) is here stated imprecisely.

Four statements, each involving the notion of a Cantorian set, are defined. Two of these are shown to satisfy in NF all conditions on $Orn(\theta)$ except (3) and (6). Another satisfies all conditions except (4) and (6), while (4) is implied by the axiom of counting. The other statement satisfies all conditions except (6). Each of these statements determines an apparently plausible extension of NF , which admits a model for ZF .

Various other results concerning these statements are obtained, a corollary being that the axiom of counting implies the existence of $\omega(\omega(0))$. Hence B is consistent relative to NF plus the axiom of counting.

Additional results not directly pertaining to the modeling are obtained. Easily established is the existence of an ordinal \mathfrak{H} such that $\text{seg } \mathfrak{H}(\leq)$ smor $RUSC(\leq)$. It is shown that \mathfrak{H} is an ω and that there are ω 's greater than \mathfrak{H} ; moreover the axiom of counting implies the existence of infinitely many such ω 's. 74 pages. \$1.00. Mic 56-545

FIXED POINT AND COINCIDENCE THEOREMS FOR MULTI-VALUED FUNCTIONS

(Publication No. 15,240)

Charles Neville Maxwell, Ph.D.
University of Illinois, 1955

Let X and Y be compact metric spaces.

There are two closely related concepts in multi-valued function theory. On the one hand, we may have functions which map X continuously into the n -fold symmetric product Y^n/S_n of Y . Given two such functions f and g mapping into the n -fold and m -fold symmetric products, respectively, then an element x in X is a coincidence of f and g if $f(x)$ and $g(x)$ have a common coordinate. In case $X=Y$, then an element x in X is fixed under such a function f if x is a coordinate of $f(x)$.

On the other hand, we may have functions mapping X continuously into the space 2^Y , of all non-empty closed subsets of Y , under the Hausdorff metric. A pair of such functions have a coincidence x if $f(x)$ intersects $g(x)$. In case $X=Y$, then x is fixed under f if x is an element of $f(x)$. There is an obvious similarity between symmetric product mappings and those mappings into 2^Y for which the image of every element is a set having at most n elements.

For any mapping f into 2^Y , the graph (f) is the collection of all (x,y) in $X \times Y$ such that y is an element of $f(x)$. As a special case, a bundle-graph function is defined here to be a closed-set mapping such that the graph forms a fiber bundle over X . It is proved here, under the assumption that X is arcwise connected, locally arcwise connected and locally simply connected, that every n -valued function is a bundle-graph function. (A function is called n -valued if the image of each point consists of exactly n elements.) In this case, the graph forms a covering space of X .

The purpose of this dissertation is to extend the Lefschetz coincidence and fixed point theorems to include symmetric product mappings and bundle-graph mappings described above. The precise results are as follows:

(1.) Let X and Y be compact orientable manifolds of the same dimension. Let f and g be mappings of X into the n -fold and m -fold symmetric products of Y , respectively. Then an integer-valued function (f,g) of the pair may be defined with the property that whenever (f,g) is not zero, f and g have a coincidence.

(2.) Let X be an arbitrary finite simplicial complex, and f a map from X to the n -fold symmetric product of X . Then an integer (f) may be defined with the property that whenever (f) is not zero, f has a fixed point.

Using these two theorems, corresponding theorems are obtained under the hypothesis that for each function the

group of the bundle is finite and the fiber modulo the group is arcwise connected.

The index (f, g) and the Lefschetz number (f) for symmetric product mappings are defined, in strict analogy to Lefschetz's definition for single-valued functions, by means of the composite homology homomorphism,

$$H_p(X) \xrightarrow{f_*} H_p(Y^n/S_n) \xrightarrow{N_*} H_p(Y),$$

where N_* is induced by the norm chain map N which associates to each cell of Y^n/S_n the sum of its coordinate cells. The results and proofs differ from the more recent work of Kakutani, Eilenberg and Montgomery, and Begle in that strong assumptions are made here about the continuity of the functions while weaker assumptions are made concerning the type of image set.

53 pages. \$1.00. Mic 56-546

ADMISSIBLE AND MINIMAX INTEGER-VALUED ESTIMATORS OF AN INTEGER-VALUED PARAMETER

(Publication No. 15,527)

Douglas Sherman Robson, Ph.D.
Cornell University, 1955

The problem of estimating an integer-valued parameter is viewed as a special case of Wald's general statistical decision problem. The chance variable X is known to be distributed over the sample space M according to a probability distribution $p(x, \mu)$ depending on a single unknown parameter μ ; and the only possible values of μ are

$$\mu = 0, 1, \dots, N, \text{ where } N \text{ is known.}$$

The function $p(x, \mu)$ is required to satisfy the following regularity conditions:

Condition 1): $p(y, \mu)p(x, \nu) < p(x, \mu)p(y, \nu)$ if and only if $p(y, \mu)p(x, \nu)$ and $p(x, \mu)p(y, \nu)$ are not both zero and $x < y$, $\mu < \nu$.

Condition 2): If $p(x, \nu) = 0$ for all x in M then either $p(x, \mu) = 0$ for all x in M for every $\mu \leq \nu$ or $p(x, \mu) = 0$ for all x in M for every $\mu \geq \nu$.

Condition 3): If $M = (x_0, x_1, \dots, x_n)$ then for every i such that $0 < i \leq n$ there exists an integer μ_i such that $p(x_{i-1}, \mu_i) > 0$ and $p(x_i, \mu_i) > 0$.

A decision function δ is allowable if δ has the form

$$\delta(x) = (\delta_0(x), \delta_1(x), \dots, \delta_N(x))$$

where

$$\delta_\alpha(x) \geq 0, \alpha = 0, 1, \dots, N, \sum_{\alpha=0}^N \delta_\alpha(x) = 1$$

for all x in M . The loss associated with the decision α when the true value of the parameter is μ is expressed by a non-negative weight function $W(\mu, \alpha)$ which is a strictly convex function of α for each fixed value of μ , and $W(\mu, \mu) \equiv 0$.

Let C be the class of all allowable decision functions δ such that

(i) for every x in M

$$\delta_{\alpha_x}(x) + \delta_{\alpha_x+1}(x) = 1, 0 \leq \alpha_x \leq N, \alpha_x+1 \leq N$$

(ii) $\delta_\alpha(x) > 0$ implies that $p(x, \alpha) > 0$

(iii) $x < y$ implies that $\sum_\alpha \delta_\alpha(x) \leq [\sum_\alpha \delta_\alpha(y)]$

Then the following facts obtain.

Theorem 1: If $p(x, \mu)$ satisfies Conditions 1) and 2) then δ is admissible only if δ belongs to the class C .

Theorem 2: If $p(x, \mu)$ satisfies Conditions 1) and 2) and $W(\mu, \alpha) = |\alpha - \mu|$ and the sample space M is finite then δ is admissible if and only if δ belongs to the class C .

Theorem 3: If $p(x, \mu)$ satisfies Condition 1) and $p(x, \mu) > 0$ for all integer pairs (x, μ) such that $0 \leq x \leq n$, $0 \leq \mu \leq N$, and $p(x, \mu) = 0$ otherwise, then there exists an integer k_p such that if $W(\mu, \alpha) = |\alpha - \mu|^k$ and $k \geq k_p$ then every admissible procedure is of the form $\delta_\alpha(x) = 1$ for $x < y$, $\delta_\alpha(y) + \delta_{\alpha+1}(y) = 1$, and $\delta_{\alpha+1}(x) = 1$ for $x > y$, where $0 \leq y \leq n$, $0 \leq \alpha \leq N$.

Corollary: If $p(x, \mu) = \binom{n}{x} \mu^x (N-\mu)^{n-x} / N^n$ then when k is sufficiently large, but finite, a procedure δ is admissible only if $\delta_a(0) + \delta_{a+1}(0) = 1$, $\delta_b(x) = 1$ for $0 < x < y$, $\delta_b(y) + \delta_{b+1}(y) = 1$, $\delta_{b+1}(x) = 1$ for $y < x < n$, and $\delta_c(n) + \delta_{c+1}(n) = 1$, where the integers a, b, c satisfy $0 \leq a < b < c \leq N$.

Theorem 4: If $p(x, \mu)$ satisfies Conditions 1), 2), and 3) and $W(\mu, \alpha) = |\alpha - \mu|$ then there exists a least favorable a priori distribution which assigns positive probability to at most $n+2$ values of μ , $\mu_0 \leq \mu_1 \leq \dots \leq \mu_{n+1}$, and if δ is a Bayes solution with respect to a least favorable a priori distribution then for $i = 0, 1, \dots, n$

$$\mu_i \leq \sum_\alpha \alpha \delta_\alpha(x_i) \leq \mu_{i+1}.$$

Minimax procedures for the case $W(\mu, \alpha) = (\alpha - \mu)$ are constructed for a few special but trivial cases; e.g., for the hypergeometric distribution for the cases $n = 1, N-3, N-2, N-1$. Limiting forms of the minimax procedure are given for the binomial and hypergeometric distributions when $W(\mu, \alpha) = |\alpha - \mu|^k$ as k increases without bound. Also minimax procedures are given for some specific, numerically defined, distributions with $W(\mu, \alpha) = |\alpha - \mu|$ and $W(\mu, \alpha) = (\alpha - \mu)^2$.
49 pages. \$1.00. Mic 56-547

TRANSFORMS OF TAUBERIAN SERIES BY RIESZ METHODS OF DIFFERENT ORDERS

(Publication No. 15,508)

Morris Tenenbaum, Ph.D.
Cornell University, 1955

The problem of this paper is, roughly speaking, one of determining for series $\sum_{k=1}^{\infty} u_k$ satisfying the Tauberian condition $\limsup_{n \rightarrow \infty} |nu_n| < \infty$, and for given real

nonnegative orders p and q , how small the quantity $|R_n^{(q)} - R_m^{(p)}|$ will be for different choices of m and n , and for what relative values of m and n it will be smallest, where $R_j^{(r)}$ is the Riesz transform of order r , defined by

$$R_j^{(r)} = \sum_{k=1}^j (1 - k/j)^r u_k, \quad j = 1, 2, 3, \dots$$

This problem has been completely solved for series meeting the above Tauberian condition. In particular, it has been solved for the special harmonic series $\sum_{k=1}^{\infty} 1/k$.

The conclusions reached are stated in the following Theorems. The Theorem numbers correspond to those in the paper.

THEOREM 2.3. Let p and q be nonnegative real numbers for which $0 \leq p \leq q$. Let $m(a)$ and $n(a)$ be positive integer valued functions of a parameter a for which $m(a) \rightarrow \infty$ and $n(a) \rightarrow \infty$ as $a \rightarrow \infty$. Let $\lim_{a \rightarrow \infty} n(a)/m(a)$ exist and equal $\lambda > 0$. Let $u_n = 1/n$ and $R_n^{(q)}$ and $R_m^{(p)}$ be its Riesz transforms of orders q and p respectively. Then (writing m, n for $m(a), n(a)$)

$$(2.31) \quad \lim_{a \rightarrow \infty} |R_n^{(q)} - R_m^{(p)}| = |\log \lambda - (X(q) - X(p))|$$

where $X(x) = \Gamma'(x+1)/\Gamma(x+1)$.

In particular

$$(2.32) \quad \lim_{n \rightarrow \infty} |R_n^{(q)} - R_n^{(p)}| = |X(q) - X(p)|,$$

and

$$(2.33) \quad \lim_{a \rightarrow \infty} |R_n^{(q)} - R_m^{(p)}| = 0$$

when and only when $\lambda = \exp(X(q) - X(p))$.

THEOREM 10.1. Let p and q be nonnegative real numbers for which $0 \leq p \leq q$. Let $m(a)$ and $n(a)$ be positive, integer valued functions of a parameter a . Let $m(a) \rightarrow \infty$ and $n(a) \rightarrow \infty$ as $a \rightarrow \infty$. Let $R_n^{(q)}$ and $R_m^{(p)}$ be the Riesz

transforms of orders q and p respectively of a series $\sum u_n$ for which $\limsup_{n \rightarrow \infty} |nu_n| < \infty$.

Then

$$(10.11) \quad \lim_{a \rightarrow \infty} \sup |R_n^{(q)} - R_m^{(p)}| \leq H \lim_{n \rightarrow \infty} \sup |nu_n|,$$

where H is defined at the end of Section 9, and when $H = \infty$, the right member is to be defined as $+\infty$ even when $\limsup |nu_n| = 0$. Moreover, (10.11) gives the best estimate in the sense that there is a series $\sum u_n$ for which

$0 < \limsup |nu_n| < \infty$, and equality holds. In particular,

$$(10.12) \quad \lim_{n \rightarrow \infty} \sup |R_n^{(q)} - R_n^{(p)}| \leq (X(q) - X(p)) \lim_{n \rightarrow \infty} \sup |nu_n|.$$

The value of H will, of course, depend on the values of q, p and the limiting value of $m(a)/n(a)$. If, however, for given values of p and q , $\lim_{a \rightarrow \infty} m(a)/n(a) = (1 - .5^{1/q}) / (1 - .5^{1/p})$, then

$$H = \log \frac{1 - .5^{1/p}}{1 - .5^{1/q}} - 2 \int_0^{.5^{1/q}-1} \frac{u^q-1}{u-1} du + 2 \int_0^{.5^{1/p}-1} \frac{u^p-1}{u-1} du + X(q) - X(p).$$

Moreover, for each set of values of p and q , there are no pair of functions $m(a)$ and $n(a)$ for which (10.11) holds with H replaced by a smaller constant.

The paper shows also how the expressions for the value of H can be simplified if (a) $p = 0, q > 0$, (b) p and q are integers, (c) p and q are non-integral but differ by an integer, (d) p and q are large integers, and finally (e) when p and q are any large real numbers.

45 pages. \$1.00. Mic 56-548

MUSIC

A SURVEY AND EVALUATION OF THE CURRENT STATUS OF MUSIC EDUCATION ACTIVITIES IN THE PUBLIC SCHOOLS OF THE UNITED STATES

(Publication No. 15,082)

Warren S. Freeman, Ed.D.

Boston University School of Education, 1955

Problem

This study is based upon The Outline of a Program for Music Education. This Outline has been prepared by the Research Council of the Music Educators National Conference as a guide to the development of the music education curriculum in the public schools of the United States.

A survey was made to determine to what extent the activities described in the Outline are being used in the

public schools of the United States, and to gain an evaluation of these activities in terms of their contribution to the musical growth of the children.

Procedure

To provide a background for this problem, a brief historical sketch is presented showing the development of the music education curriculum, and a review of previous research in the area of curriculum development.

The data presented has been gathered by means of an inquiry form based on the individual items contained in the Outline of a Program for Music Education. The inquiry form requested the respondents to indicate the frequency of each activity and an evaluation of its contribution to the musical growth of the child. Certain other pertinent information was also requested such as the size of the school

system, the number of music teachers, the cost per pupil, the financial support of the music program and the extent of community music activities.

The inquiry form was sent to a stratified random sample selected from five different population strata. The replies used in the study came from 282 different communities in 45 states.

Validity was established through careful sampling techniques to insure a population in the sample which would be representative of all public school music programs. Reliability was established through personal visits to 30 communities to recheck answers as submitted by the respondents in these communities.

Conclusions

1. In spite of the declaration by the Research Council of the Music Educators National Conference that the items listed in the Outline of a Program for Music Education constitute the very minimum in requirements for music programs in the public schools of the United States, few communities use all or nearly all of the items listed in the Outline.

2. A pattern of frequency of the various activities reveals the vocal music is the most prevalent and important activity. In descending order of frequency, the others are: instrumental music, listening, rhythmic activity and creative activity.

3. The amount of time spent on music activities increases with each grade from the kindergarten through grade six from an average of about 20 minutes per day to over 25 minutes per day. On the Junior and Senior High School level, most of the activities take place during one or more school periods in the same manner as other subjects in the school curriculum.

4. The general music class is the most frequently mentioned music activity on the Junior High School level.

5. The band is the most popular instrumental activity at the secondary level, with the orchestra definitely playing a less important role.

6. In vocal music at the secondary level, the boys and girls glee clubs are an important part of the music education program. Worthy of mention is the widespread interest among boys in all phases of vocal music.

7. Little or no activity is reported in the so-called classroom subjects such as theory, harmony and music appreciation.

8. A comparison of 30 communities which spend most for their education with 30 which spend least has revealed that there is a richer music program in the communities which spend most for their education. This same situation prevails in a comparison of the extent of community music activities and the richness of the school program. This comparison has shown that where a rich program of high school music activities takes place, there is a corresponding increase in the extent of the community music program.

193 pages. \$2.41. Mic 56-549

A FOLLOW-UP STUDY OF THE GRADUATES OF THE SCHOOL OF MUSIC OF THE UNIVERSITY OF ILLINOIS

(Publication No. 15,227)

Alfred Wendell Humphreys, Ed.D.
University of Illinois, 1955

This survey, embracing the graduates of the School of Music for the period 1940-1953, attempts to answer the general question: Are the experiences provided by the curricula of the School of Music, University of Illinois, adequately preparing music students for their ultimate work in the area of music? It is believed that the answer to this question will be of concern in any evaluation of the curriculum offerings of the School of Music.

Through the use of a questionnaire as the chief method of data collection, the graduates were requested to supply information about their present work; their opinions about their preparation at the School of Music; their ideas about the guidance services at the University of Illinois; and their suggestions and comments for the improvement of the preparation provided by the School of Music and the University of Illinois.

The alumni were asked to evaluate their preparation in music through the use of a "competency analysis" in which musical competencies were translated into musical behaviors as far as possible; the various behaviors were to be considered by the graduates in terms of the importance of the behavior in the present work of the graduates and as to the adequacy of the preparation in the behavior.

An historical survey of past curriculum procedures revealed that the School of Music has been oriented in the traditional conservatory concept of function, and that it has been generally resistant to serious curriculum revisions in the past.

One hundred eighty-five alumni, or 43.3 per cent of the total number of graduates during the period used as a sample, responded to the questionnaire. A synthesis of the tremendous amount of data collected in the survey would indicate the following suggestions of the graduates for the improvement of the preparation provided by the School of Music: (1) The establishment of a functional and realistic guidance program for music students; (2) The establishment of music curricula upon the basis of their use and effectiveness in the lives of music graduates; (3) An emphasis on curricula which will prepare students to become good teachers of music, either in school situations or as private teachers of music; (4) A de-emphasis of "professional music" since no work seems to exist therein for the vast majority of music graduates; (5) The establishment of programs to provide for training in church music activities; (6) The provision of more adequate learning experiences in the conducting of music groups of all kinds; (7) The modification of music education curricula to provide preparation in all phases of school music; (8) A more practical and realistic approach to "methods" courses; (9) An emphasis on a more practical knowledge and use of the keyboard, particularly for students in music education; (10) The development of materials and methods courses in piano, voice, and class voice.

The implementation by the School of Music of the foregoing list of suggestions will be utterly dependent upon the educational philosophy operating in the School of Music. Many traditional concepts, methods of doing things, and

conventional restrictions will have to be abandoned; a willingness to change will be imperative for broad philosophical concepts are inherent in some of the suggestions.

It would seem that, for any school of music to maintain its place in a society undergoing vast changes, a continuum of curriculum analysis and investigation is essential.

156 pages. \$1.95. Mic 56-550

SERIES AND STRUCTURE: AN INVESTIGATION INTO THE PURPOSE OF THE TWELVE-NOTE ROW IN SELECTED WORKS OF SCHOENBERG, WEBERN, KRENEK AND LEIBOWITZ

(Publication No. 14,663)

Wilbur Lee Ogdon, Ph.D.
Indiana University, 1955

This thesis primarily restricts itself to the representative leaders of three "generations" of Twelve-note composers, Arnold Schoenberg, Ernst Krenek, and Rene Leibowitz. It is not a biographical study nor is it directly concerned with sociological or philosophical issues. Rather, it interests itself with technique: how does series and series method conform to, coordinate with, or determine other factors of composition. Especially is the author interested in if and how a series technique is geared to the structure of a composition.

The organization of the thesis is simple. After a brief orientation to the history of twelve-note writing, the author investigates the technical methods of the three composers separately. (Webern is treated as an extension of Schoenberg's own apparent concern with function through differentiated materials.) A final chapter then comparatively summarizes the findings of these three studies. A large part of each study is devoted to an analysis of a composition considered significantly typical of the composers' serial methods. The *Klavierstück*, op. 33a, the *Symphonic Elegy* for String Orchestra, and the *Third String Quartet* represents Schoenberg, Krenek and Leibowitz respectively.

The author has sought to demonstrate that there is no single and simple twelve-note technique of composition. Related as they undoubtedly are, these composers do not display unanimity as to the purpose and accomplishments of the series. Similar technique and methods of manipulating the series are observed, but a fundamental disagreement as to the comprehensive authority of the series is noted as well.

The author concludes that Leibowitz represents a continuation of the Schoenbergian method by extending and intensifying the dominion of the series over the form. Krenek, on the other hand, breaks with Schoenberg by reducing and even disregarding the form function of the row in favor of its potentialities as a source of motivial characterization and variation.

The thesis lays no claim to conclusiveness. It purports to provide one more document to aid the formulation of a considered and informed understanding in our time of a vitally evolving method of composition.

341 pages. \$4.26. Mic 56-551

THE DEVELOPMENT OF A CONCEPT OF MODULATION IN THEORY FROM THE 16TH TO THE EARLY 18TH CENTURY

(Publication No. 14,665)

Helen Olive Rogers, Ph.D.
Indiana University, 1955

Modulation as a harmonic technique generally refers to the practice based on the tonal relations inherent in the major-minor key system. In order to define the practice and to formulate the theoretical concept of harmonic modulation, it is first necessary that the tonal system on which it is based is clarified in practice and systematized in theory. The process of the evolution of the major-minor tonal system, and hence, of the probable inception of harmonic modulation, is generally recognized to have taken place in the musical practice of the 16th and early 17th centuries. Therefore, it is logical to assume that the formulation of the theoretical concepts of tonality and modulation may be found in the treatises representative of 16th and 17th century practice.

The early 16th century theorists project the medieval system of eight modes as the tonal basis for musical practice. In 1547, in the *Dodecachordon*, Glarean makes the first important contribution to the evolution of a new tonal system through his extension of the system from eight to twelve modes, based on his observation of the use of these in the practice of his time. By means of this extension, Glarean gives theoretical sanction to the Ionian and Aeolian modes, and makes possible the theoretical recognition of the two type modes which become the basis for the major-minor system of classical tonality.

Glarean's twelve-mode system is adopted by most of the 16th and 17th century theorists who follow him. Of these, Zarlino is particularly important for several contributions. He rearranges the order of the modes, placing the Ionian first, and emphasizes the increasing frequency of the use of the Ionian and Aeolian modes in practice. He defines two distinct types of modes on the basis of the harmonic and arithmetic division of the 5th. The latter is supported further by his experiments with the tuning of the intervals of the diatonic scale. From these experiments he derives the diatonic-syntonon in which the thirds are consonant and thus Zarlino lays the foundations for a harmonic science. These ideas, as well as his recognition of the bass voice as the foundation for the polyphonic complex above it, are clarified and carried to a further point of development by the 17th century theorists.

The earliest concept of modulation may be defined as that based on the practice of mixed modes or change from one mode to another which the theorists observe in both plainsong and polyphonic composition. Further development of this concept may be observed in the treatises of the late 16th and 17th centuries, particularly in those of Zarlino and Cerone. Both of these theorists, in addition to their recognition of modal mixture through the changes within the modal ambitus, describe a change from one mode to another based on the use of irregular cadences within the modal ambitus, particularly in polyphonic music. This may be defined as a type of "modal modulation" based on the tonal relations within the "ambitus modi."

The first clear projection of this concept within the major-minor tonal system may be found in the English treatises and "Instruction" books of the 17th century.

Among these, the works of Thomas Campion and Christopher Symphon are the earliest to show recognition of the major-minor key system. This may be seen in their distinction of the keys as flat or sharp according to the position of the major and minor thirds within the 5th above the keytones of the diatonic system. Further, these theorists, and their successors to the close of the century, indicate an understanding of key relation and modulation through their description of the practice of taking the "closes" permitted to a given key in both the major and minor modes.

In the figured-bass treatises of the late 17th and early 18th centuries, the evolution of the major-minor key system reaches its culmination. Improvements in the tempering of the keyboard instruments make possible the development of the practical techniques of modulation such as may be found in the circle of keys. This permits the clarification and expansion of usable key-relations within the major-minor tonal systems. Success in such practical developments results in the final stabilization of the major-minor tonal system, the clarification of harmonic relations with this system, and the formulation of a concept of harmonic modulation in theory.

482 pages. \$6.03. Mic 56-552

THE FORMAL CONSTRUCTION OF MOZART'S
OPERATIC ENSEMBLES AND FINALES
(VOLUMES I AND II)

(Publication No. 15,473)

Denton Rossell, Ph.D.

George Peabody College for Teachers, 1955

Major Professor: Vernon H. Taylor

The writer has undertaken a critical analysis of Mozart's operatic ensembles and finales in order to determine the extent to which musical formalism exists in these compositions; to describe the formal patterns; to study their association with the drama; and to trace any perceptible developments in the composer's style of composition.

The most important phase of this study was the examination of the music itself. The great number of the musical works, their varied forms, and the considerable length of many imposed analytical difficulties. The investigator found a graphic type of analysis to be most useful in creating a pictorial representation of the formal designs. This method of analysis, applied to each of the sixty-eight pieces of music, proved helpful in describing the works.

Generalizations regarding Mozart's ensembles and finales are made difficult by the multifariousness of the compositions and the variety of the operas. However, there are many things to be observed.

The composer's ubiquitous formalism is to be found (1) in the shaping of melodies and in their repetitions, (2) in the use of rhythms, (3) in the vocal groupings, and (4) in the tonality.

1. Melodic repetitions. The repeated melodies which Mozart uses to create formal designs usually originate in the vocal parts where, through sensitive rendering, they express characteristics and emotions of the persons with

whom they are associated. Immediate repetition of a theme by the same character is Mozart's simplest and most frequently used plan of melodic repetition. Other usages include occasional repetitions throughout an ensemble or section, the employment of short motives or persistent orchestral themes as unifying agents for an entire ensemble or section, the use of melodic sequences, the fashioning of similar melodic patterns to give unity to an entire finale or even an entire opera.

2. Rhythmic aspects. Unity is sometimes achieved by the repetition of rhythmic patterns. An acceleration of rhythmic movement is usually to be found in both ensembles and finales although that of the finales is combined with an alternation of slow and fast tempi.

3. Vocal groupings. Designs are even formed by the arrangement of the voices. The usual vocal plan is one of solos followed by vocal combinations. This results in an accumulation of voices (and sometimes instruments) as the ensemble progresses. However, other plans are to be encountered; for instance, solos may be placed in the middle with solid combinations at beginning and end.

4. Tonality. Each opera is conceived as a work in a certain key; the key of the overture is the key of the opera's conclusion. Likewise, each ensemble and each finale, with the exception of four of the earliest, is a piece in a certain key.

The tonal plans of the great finales are the greatest demonstrations of tonal formalism to be found in opera.

The first example of such planning is to be found in the finale to *L'Oca del Cairo* where the tonal design may be described as ternary; two keys, linked together, form opening and closing units which frame the central portion. This plan may be seen in the tonal outlines given below.

| | | | | | | | |
|---------------------------|-----------|----------------|----------------|----------------|----------------|---|-------------------------------|
| <i>L'Oca del Cairo</i> | Finale I | B ^b | F | d | c | F | B ^b |
| <i>Le nozze di Figaro</i> | Finale I | E ^b | B ^b | G | C | F | B ^b E ^b |
| <i>Le nozze di Figaro</i> | Finale II | D | G | E ^b | B ^b | G | D |

In the finales to *Don Giovanni* and *Die Zauberflöte* the key scheme of the first half was reversed to become the key scheme of the last half.

| | | | | | | | | | | | | | |
|------------------------|-----------|----------------|----------------|---|---|----------------|----------------|---|---|----------------|---|---|---|
| <i>Don Giovanni</i> | Finale I | C | F | d | F | B ^b | E ^b | C | G | E ^b | d | F | C |
| <i>Don Giovanni</i> | Finale II | D | B ^b | F | d | G | G | D | | | | | |
| <i>Die Zauberflöte</i> | Finale I | C | F | C | G | C | F | C | | | | | |
| <i>Die Zauberflöte</i> | Finale II | E ^b | c | F | C | G | C | G | c | E ^b | | | |

Musical design is present in these ensembles and finales to a degree that is extremely unusual in operatic works, and yet, it is inherent in the subject, clarifying, rather than obscuring the dramatic truth. The designs are multifarious and cannot be described by standardized labels for musical form. 694 pages. \$8.68. Mic 56-553

PHARMACOLOGY

METABOLIC FATE OF LEVO-3-HYDROXY-N-ALLYLMORPHINAN (LEVALLORPHAN)

(Publication No. 14,735)

Lewis Stanley Schanker, Ph.D.
The University of Wisconsin, 1955

Supervisor: Assistant Professor Gilbert J. Mannering

Levallorphan (levo-3-hydroxy-N-allylmorphinan) is known to be a potent antagonist to many of the pharmacologic actions of the morphine-type analgesics. However, little is known about its mechanism of action or its metabolic fate. Studies were made to determine the metabolic fate of Levallorphan and to determine whether the property of antagonism is inherent in the Levallorphan molecule or in some metabolic product of this compound.

Levallorphan tartrate was incubated aerobically for three hours at 38°C. with rat liver slices in a modified Krebs-Ringer-phosphate medium. The incubated mixtures were then extracted with appropriate solvents and the extracts subjected to paper chromatographic analysis. The urine from rats injected subcutaneously with 10, 70 or 250 mg. per kg. of Levallorphan tartrate was collected for 24 hours and processed in the same manner. All chromatograms revealed the presence of two major metabolic products of Levallorphan. Both of these products (Metabolite I and Metabolite II) were isolated in crystalline form from the chromatograms and were subjected to a series of identification procedures. Metabolite II was identified as norDromoran (3-hydroxymorphinan). Metabolite I has not been fully characterized, but its empirical formula is $C_{19}H_{25}NO_2$, thus differing from that of Levallorphan by the presence of one additional oxygen atom.

The urinary excretion of Levallorphan and its metabolites was quantitatively estimated in the rat employing paper chromatographic techniques in combination with a methyl orange colorimetric method. The 24-hour urinary excretion of Levallorphan and the two metabolites accounted for only 12 per cent of the administered dose of Levallorphan. This 12 per cent consisted of the following: free Levallorphan, 1.4 per cent; bound Levallorphan, 3.3 per cent; free Metabolite I, 3.5 per cent; bound Metabolite I, 2.8 per cent; free norDromoran, a trace; bound norDromoran, 1.0 per cent. The urinary excretion of Levallorphan and its metabolites appeared to be almost complete in 24 hours.

A species survey of Levallorphan metabolism indicated that norDromoran was formed in the rat, mouse, guinea pig, rabbit and dog. Metabolite I, however, was formed only by the rat and mouse and possibly by the rabbit.

Preliminary studies on the pharmacologic actions of levo-norDromoran indicated that it is a respiratory depressant in rabbits when administered intravenously in a dose of 10 mg. per kg. This depression is readily antagonized by 1.0 mg. per kg. of intravenous Levallorphan tartrate. Levo-norDromoran in intravenous doses of 3.0 and 6.0 mg. per kg. did not antagonize morphine-induced respiratory depression in rabbits. Levo-norDromoran was found to be approximately 1.5 times more toxic than Levallorphan in mice.

Thus, norDromoran, a metabolic product of Levallorphan in all species studied, does not possess the antagonistic properties of its parent compound. The small quantity of Metabolite I available did not permit pharmacologic investigations.

91 pages. \$1.14. Mic 56-554

PHILOSOPHY

THE REPUTATION OF DAVID HUME IN AMERICA

(Publication No. 15,665)

Earl Burk Braly, Ph.D.
The University of Texas, 1955

For abstract see Language and Literature, General.
331 pages. \$4.14. Mic 56-523

THE THEORY OF IMMEDIATE PERCEPTION AMONG TWENTIETH CENTURY SCHOLASTIC PHILOSOPHERS WITH SPECIAL EMPHASIS ON THE CONTRIBUTIONS OF DOMET DE VORGES AND LEON NOEL

(Publication No. 15,626)

Cornelius Fay, Ph.D.
Columbia University, 1955

It is the aim of the dissertation to account for the rise of a certain theory of immediate perception among present day Scholastics. This theory holds that the intelligence grasps the fact of the existence of the object immediately, since by its intimate association with the senses it confers on them a superior value. This particular theory of immediate perception is to be distinguished from the common

sense theory that the senses purely and simply grasp existence, from the theory that we infer the existence of the object from its representation in consciousness by virtue of the principle of causality, and from the theory that we apply the *a priori* notion of existence to phenomena.

The dissertation begins by establishing that at the turn of the century such a theory of immediate perception was not in vogue. It then outlines a little known argument between Count Domet de Vorges and Le Cardinal Mercier concerning sense perception, and proceeds to show that the theory defended by Domet de Vorges was unique with him among the Neo-Scholastics. Since Domet de Vorges won no following, and Msgr. Noël became the principal apostle of the spread of immediatism, the evolution of Noël's views on sense perception is next presented. An attempt is made to show that epistemological discussion held in Germany during the eighteen-nineties probably had considerable influence on the development of Scholastic thought. The writings of Richard Avenarius, Wilhelm Schuppe, and Leonard Nelsen are especially noteworthy in this connection. All three of these writers, though in different ways, held theories which abandoned the tradition of conceiving consciousness according to the analogy of a container. They tended to eliminate the "representation" in perception, from which the existence of real things (i.e., bodies) was somehow inferred. Thus finding a bridge from the appearance to the reality ceased, for them, to be the classic epistemological problem. In addition to this German discussion, the movement was aided by new perspectives taken by several Scholastic writers, and by a re-examination of St. Thomas and John of St. Thomas.

In outlining the whole of Msgr. Noël's epistemology, an effort is made to describe the manner in which the thesis concerning the immediacy of perception affects the key theses of a realist theory of knowledge. This outline is followed by a criticism of Msgr. Noël's theory of the sensation itself. In particular, two points made by the Louvian professor are questioned: first, the notion that a theory of sensation is a post-epistemological problem; and second, the notion that we perceive "sensations." It is maintained, in opposition to Msgr. Noël, that an epistemological discussion of perception is incomplete without a satisfactory theory of sensations; and that sensations are not sensed but rather had, that they are an activity of the perceiver and not the object of perception.

Finally, a pair of appendices illustrates the pre- and the post-history of the problem; the former in the controversies between Peillaube and Gardair and between Thiéry and Hallez, the latter in the controversy which took place between Noël and Gilson. A last appendix contrasts main types of contemporary Scholastic theories of knowledge with the epistemology of Domet de Vorges and Léon Noël, illustrating the way in which the new immediate realism can criticize these competing theories and withstand criticism from them. 241 pages. \$3.01. Mic 56-555

THE AESTHETICS OF FRANCIS HUTCHESON AND DAVID HUME

(Publication No. 15,216)

William Harold Halberstadt, Ph.D.
University of Illinois, 1955

This work attempts, for the first time, to give a complete presentation of the aesthetics of David Hume (1711 -

1776), drawn from all his philosophic writings, and considered in the light of an exhaustive investigation of the aesthetics of the man who most influenced his entire philosophy, Francis Hutcheson (1694 - 1746).

Hutcheson held that men perceive beauty and deformity by means of an internal sense of beauty, analogous to the five external senses. Beauty is not in the object, but is nevertheless universal because of this sense which exists in all mankind. This sense is constituted so as to respond with approbation to aesthetic situations in which a principle of uniformity amidst variety is manifest. Hutcheson distinguishes two types of beauty, original and comparative, of which the latter is imitative of the former. From the sense of beauty Hutcheson argues design and wisdom in the First Cause.

In Hume's philosophy, the Hutchesonian internal sense of beauty became a sentiment or feeling, called "taste." Taste is a type of perception, viz., a direct, calm, impression of reflection. It responds with aesthetic approbation to situations in which there are the proper external qualities of objects. Although Hume never explicates these qualities, we try to show, with evidence from his writings, that they must be those qualities which are useful or immediately agreeable to the object itself or to others. Obviously, a quality can only be useful or agreeable to an object if the object is an animate one.

Taste is, for Hume, based on sympathy, and universal. It admits of standards of which the expert critic is the best index. Although mankind is largely agreed on general aesthetic principles, the expert, by his greater delicacy of taste, serves a valuable social function by helping other percipients to discover particular aesthetic principles.

A consideration of Hume's theory of tragedy, and of the relation of art and society in his aesthetics, ends the presentation of the two aesthetic theories.

345 pages. \$4.31. Mic 56-556

A CRITICAL STUDY OF F. H. BRADLEY'S ETHICAL STUDIES

(Publication No. 15,630)

Robert Varlan Hannaford, Ph.D.
Columbia University, 1955

The essay traces the development of the ethical theory which Bradley first erects and then criticizes. His theory asserts that true happiness and true self-realization is to be achieved only by the individual becoming one with the will of the moral community and performing its dicta through his particular function in society. The goal of the self is happiness, is the Good, is a consistent specification or realization of the will of the community. All three definitions of the goal of the moral self may be used interchangeably because all three are identical for morality, as Bradley presents it. The goal of the self is the same as the goal of society because the will of society is the source of the individual self. This goal is good, true and real: real because it is a consistent comprehensive whole; good because the moral world determines it to be so, and true because it is identical with the moral world.

Bradley criticizes this theory on the ground that the Good realized in society is not wholly good nor does it include all phases of human realization. The moral agent is

to achieve a fuller realization of the Good by idealizing and identifying himself with the pattern of the concrete moral universal. The moral universal consistently integrates the diverse phases of the moral life; its pattern is a unity in diversity. The moral agent must identify himself in the abstract pattern of the universal or he must, through faith, declare that this ideal will exist in God.

The essay then shows that Bradley's theory, outlined above, is subject to a number of difficulties. It employs two kinds of universals, each of which is opposed to the other. As a result of the two kinds of universals, Bradley ends with two standards of truth, goodness and reality. The ethics of conventional morality is found to coalesce with the metaphysics of the concrete universal used in his logic and metaphysics. His ethics describes the systematic unity of discourse, and his metaphysics the systematic unity of existence. Both his logic and his ethics assert the inadequacy of ordinary universals to describe that systematic unity and both rely upon the validity of the concrete universal. In his logic as well as his ethics, he ends with dual standards of truth and goodness. In his metaphysics, he avoids the dualism resulting from his criticism of abstract universals, but in doing so, he asserts that truth, completed individuality or reality can be found only in Absolute Reality.

His ethical theory begins by celebrating the world's morality, which is what originally aggravated the need for inquiry into the nature of the Good Life. It ends by pursuit of complete and perfect individuality which leads either to religion (which was an already available alternative) or to identifying oneself with Absolute Reality (which is accessible only to mystics). As a theory describing the world's morality, Bradley's argument is lacking in evidence; in fact, there is evidence to show that it is not true. As a prescriptive theory, it is incorrigibly dualistic, and neither of the two standards can be considered adequate, as Bradley presents them.

Bradley's only avowed aim was to overthrow the existing metaphysical bases of English thought. In this, he was successful. His work led and sustained the flow of English idealistic literature, which replaced Utilitarian, Intuitionist and Neo-Kantian literature, prevalent at the time *Ethical Studies* was written. 156 pages. \$1.95. Mic 56-557

LIBERALISM IN TRANSITION: THE POLITICAL PHILOSOPHY OF LEONARD TRELAWNY HOBHOUSE

(Publication No. 15,633)

Arnold Saul Kaufman, Ph.D.
Columbia University, 1955

It is the aim of this dissertation to i) state L. T. Hobhouse's social philosophy in as intelligible and coherent a way as possible; ii) criticize and evaluate his social thought; and iii) determine the theoretical and historical significance of his social philosophy, especially when viewed in terms of the history of liberal thought.

The book is divided into three parts. The first contains a brief account of Hobhouse's life and a description of the chief historical and philosophical influences which shaped his thought. Herbert Spencer, Auguste Comte, T. H. Green, and J. S. Mill exerted the most important philo-

sophical influences, with Mill looming largest because Hobhouse's social philosophy is primarily a development of Mill's social thought, not of Green's views as is often claimed.

A critical exposition of Hobhouse's social philosophy constitutes the second part. Adequate representation of his ultimate ideal social harmony requires that certain aspects of his metaphysical and epistemological positions be expounded. Also crucial is the relevance of his psychological and sociological investigations to the main ideas of his social philosophy. These background ideas are sketched and Hobhouse's social ideal explained in the initial chapters of the second part. The other fundamental concepts of his social philosophy are then analyzed. The use to which he put this theoretical apparatus in his theory of the state and in his elaboration of a system of rights concludes Part Two. The rights which make up the system of rights are called intermediate ideals and are regarded as defining Hobhouse's liberalism.

Of special concern is Hobhouse's treatment of the ideal economic freedom. An extensive account is given of his effort to provide a liberal justification of many "collectivist" economic policies. It is pointed out that he was probably the first to try to develop a liberal philosophy of trade unionism. The other intermediate ideals discussed are civil liberty, political freedom, freedom of information and opinion, freedom of association, national freedom, and international freedom. The inadequacies of Hobhouse's discussion of each of these policy-directing ideals are pointed out.

In Part Three an over-all evaluation of Hobhouse's social philosophy is attempted. The author's conception of the instrumental nature and function of political philosophy is formulated and Hobhouse's own approach criticized in terms of it. The underlying inadequacies of Hobhouse's views are then examined, and a root contradiction is uncovered. Finally, the significance of Hobhouse's philosophy for contemporary liberalism (primarily British and American) is discussed.

The author maintains that the main significance of Hobhouse's work lies in the scope of his effort to provide contemporary liberalism with a coherent theoretical base after the older laissez-faire approach had been all but abandoned in the field of practical politics. The main inheritor of Mill's social philosophy, Hobhouse carried liberal theory from the frontiers established by Mill to the new liberal frontier — concern with managerial tyranny. Hobhouse himself believed that the best kinds of socialism and liberalism had a common theoretical base, and he set out to demonstrate this fact. Certainly it may be claimed that he, more than any other liberal theorist, assimilated the leading ideas of democratic socialism to liberal theory. Thus, on the positive side, it is the scope, coherence, and relation to socialism of his political thought which is emphasized. Negatively, the diffuseness and rhetorical nature of much of his writing are severely criticized, and his failure to deal with certain fundamental problems of liberal theory highlighted. In the latter category the primary failing is the absence of any attempt to develop a theory of liberal political strategy, especially with regard to political parties. 465 pages. \$5.81. Mic 56-558

THE SIGNIFICANCE OF "QUALITATIVE THOUGHT" IN DEWEY'S PHILOSOPHY OF ART

(Publication No. 15,639)

Dinesh Chandra Mathur, Ph.D.
Columbia University, 1955

The concept of "Qualitative Thought" is fundamental and basic to Dewey's entire philosophy of experience. And it dominates his philosophy of art. By "qualitative thought" Dewey means that all thought (in its widest sense) arises within a situational context and is controlled and regulated by the fused pervasive quality of that context. In emphasizing that reflective thinking—whether scientific, moral or artistic—never gets away from qualitative background Dewey has given thought a firm footing in experience. The difficulties involved in regarding thought as something entirely "theoretical" or "intellectual" are well known to the students of philosophy. Once thought and immediate qualitative experience are disjoined it becomes an insoluble problem how the former operates upon the latter. Dewey has shown that thought arises within concrete experiential situations to render them more determinate, coherent and harmonious. Without the control of the unique pervasive quality of the situation thought would not know where it is going.

Though all thought is controlled by the pervasive quality of the subject matter, the latter is most intensely experienced in artistic thinking both in its creative and appreciative aspects. As the controlling quality of a work of art it provides the guiding thread—the qualitative context—to esthetic analysis, discrimination and criticism. The various distinctions of emotion, expression, meaning, form and substance in a work of art would not be intelligible without this fused permeating quality. The various

discriminated qualities of a work of art are distinctions of this pervasive quality.

In the form of a wider context of society and nature this notion accounts for the haunting and poignant quality, and the spiritual—almost mystical—effect of a work of art on us. The experience and the "feel" of something beyond, something encompassing our immediate experience is heightened and accentuated in esthetic experience and lends it a rare charm and fascination. Dewey's concept of "qualitative thought" takes care of such an experience without the aid of any transcendent explanation.

This concept through its functioning in esthetic experience saves Dewey's naturalism from being an abstract and mechanical system. It restores the reality of the qualitative richness, variety and charm of our world of experience. It obviates the charge that Dewey's naturalism is thin and narrow. His naturalism includes all the qualitative richness revealed in esthetic experience and has a genuine religious and mystical dimension. Esthetic experience with its qualitative context explains much of our intimate, unique and unduplicable experiences of rapture and ecstasy without positing a transcendent world of pure essences.

Dewey's concept of "qualitative thought" has been very fruitful in his philosophy of esthetic experience but it by itself will not suffice for purposes of detailed esthetic discrimination, analysis and criticism. Perhaps it was not intended to do so. The task of detailed analysis and criticism is the job of the critic. Dewey as a philosopher has certainly supplied a very fruitful concept for a philosophy of experience in all its forms and especially for esthetic experience. Without this unifying pervasive quality the esthetic situation will fall asunder and would not be intelligible in its distinctive nature.

206 pages. \$2.58. Mic 56-559

PHYSICS

PHYSICS, GENERAL

INTERACTION OF MICROWAVES IN GASEOUS DISCHARGE PLASMAS: APPLICATION TO THE STUDY OF FUNDAMENTAL PROCESSES IN GASES

(Publication No. 15,178)

John Melvin Anderson, Ph.D.
University of Illinois, 1955

Interaction between microwaves simultaneously propagated through gaseous discharge plasmas, based upon a theory proposed for the similar phenomenon of radio wave interaction in the ionosphere—the "Luxembourg Effect,"—is experimentally observed. The controllable laboratory microwave interaction is utilized for a study of certain fundamental processes in plasma and permits a determination of numerical parameters describing these processes.

Plasmas in helium and nitrogen are studied to obtain the probability of collision of the electrons for momentum

transfer, P_m , in the range of electron energies from .039 ev to .5 ev. At an electron energy of .039 ev (room temperature $\sim 300^\circ\text{K}$) P_m in helium is found equal to $23.4 \text{ cm}^2/\text{cm}^3$, referred to 0°C and 1 mm Hg and in nitrogen P_m is equal to $60 \text{ cm}^2/\text{cm}^3$. The fractional excess energy loss of the electrons upon collision, G , is measured over a similar range of electron energies. At .039 ev G in nitrogen extrapolates to 4×10^{-4} and falls monotonically to 2×10^{-4} at .5 ev. In helium G is found to be $\sim 2.7 \times 10^{-4}$, the value expected as based on classical considerations. At the relatively high electron densities ($\sim 10^{11} \text{ elec/cc}$) of this experiment, the positive ions of the essentially charge-neutral plasma are observed to contribute considerably to the total momentum transfer cross section for electron collisions. An "effective" cross section for positive ion scattering of electrons is found equal to $2 \times 10^{-10} \text{ cm}^2$ in the isothermal plasma at 300°K , and $n_e \sim 10^{11} \text{ elec/cc}$, which is $\sim 3 \times 10^5$ times greater than the cross section for collision with helium atoms, which is $6.8 \times 10^{-16} \text{ cm}^2$. The factor G for electron-ion collisions is estimated to be considerably less than the classical value based upon the particular ion considered.

An investigation of the emitted light of the afterglow as detected by photomultipliers reveals on the one hand a quenching of the afterglow upon absorption of microwave energy in the plasma, this being associated with the increase of electron temperature and the resultant decrease in the rate of electron-ion recombination. On the other hand, a further increase of electron temperature (in the range ~ 0.5 eV) is observed to increase the emitted afterglow light and is attributed to the excitation of atoms in the metastable states.

Qualitative examinations of the effects associated with wave interaction are made in xenon, neon, argon, and krypton, and interesting effects associated with the Ramsauer minimum in the appropriate gases are observed.

Application of a steady magnetic field to the plasma is observed, in general, to enhance the observed effects as is predicted by existing theories of "gyro-interaction."

An approximate method for determination of microwave propagation properties in waveguides inhomogeneously filled with ionized gases is developed, which allows an inclusion of the spacial variation of the parameters contributing to the primary electromagnetic constants (σ, μ, ϵ) of the plasma medium. 161 pages. \$2.01. Mic 56-560

THE USE OF THE FIELD EMISSION MICROSCOPE FOR THE INVESTIGATION OF SURFACE CONDITIONS ON AN ALLOY OF MOLYBDENUM AND ZIRCONIUM

(Publication No. 15,590)

Lucian Arthur D'Asaro, Ph.D.
Cornell University, 1955

This investigation shows that the field emission microscope provides a tool which is well adapted for determining the distribution of the components of an alloy of refractory metals on the surface of the alloy. An alloy consisting of a few percent of zirconium in molybdenum is used.

Points for use in the field emission microscope are prepared from the alloy by grinding and electrolytic etching. Pressures in the range of 10^{-10} mm Hg are obtained. With these low pressures, after heating the field emitting point to 2000°K to remove oxides and to obtain a standard condition, the surface can be maintained free of oxides for several hours.

When the clean standard alloy surface is heated at temperatures lower than 2000°K, diffusion of zirconium from the interior onto the surface is observed. This zirconium is always found on planes near the 100 plane, or on the 100 plane. A model of the surface indicates that the binding energy of zirconium on the surface may be greater near the 100 plane, because of more nearest neighbors for adsorbed atoms. At the lowest temperatures at which diffusion occurs, the zirconium appears initially in a different configuration than it does at higher temperatures. This effect is thought to be due to the reduction of migration rate at lower temperatures. If this is true, then it follows that the zirconium diffuses from the interior onto the surface at the region where the zirconium initially appears.

After the field emitting point is flashed to about 2400°K, the rate of diffusion of zirconium from the interior onto the surface increases. This increase is interpreted on a vacancy model of diffusion as due to an increased vacancy concentration produced within the alloy by the flashing.

The rate of diffusion of zirconium from the interior onto the surface increases with increasing temperature. At a constant temperature, the diffusion process is repeatable. A quantity interpreted as the activation energy for diffusion of zirconium from the interior onto the surface can be obtained. After the flashing, this quantity is found to be 1.35 electron volts.

When the emitter is heated at a high enough temperature for evaporation to occur, a maximum is observed in the quantity of zirconium which is present on the surface as a function of time. This maximum is interpreted on the basis of the Wagner-Johnson vacancy theory of diffusion. Vacancies diffuse into the material during the cleaning process. These vacancies are believed to remain near the surface, where they are bound with zirconium atoms. The zirconium-vacancy pairs diffuse out during the initial stages of heating, producing a maximum in the amount of zirconium present on the surface as a function of time.

During the initial stages of the lowest temperature diffusion small parallelogram shaped patterns, all oriented in the same way, are seen on the 100 plane. These patterns are also seen after heating at a temperature just below the cleaning temperature. The work function of the sources of these patterns, the field at the surface of the sources, and the size of the sources are determined by a method of matching the Fowler-Nordheim equation to an experimental plot of field emission current versus potential.

Oxide free surfaces of the alloy of 5% zirconium are found to produce a different field emission pattern than oxide free surfaces of the alloy of 1% zirconium. The principal difference is in the relative intensity of emission from the 211 plane. Polycrystalline surfaces of the 5% alloy produce anomalous patterns.

165 pages. \$2.06. Mic 56-561

VIBRATIONAL SPECTRA OF LEAD ALKYL

(Publication No. 15,454)

Jasper Andrew Jackson, Jr., Ph.D.
The University of Oklahoma, 1955

Several previous workers¹⁻⁹ have investigated the infrared and Raman spectra of lead alkyls. However, since these compounds are very unstable and extremely photosensitive, only incomplete spectral data have been published. In the present work techniques have been developed for obtaining the Raman spectra of lead alkyls at temperatures so low that photochemical decomposition was negligible. The samples were cooled to temperatures as low as -130°C by a stream of nitrogen that had passed through a copper coil immersed in liquid nitrogen.

Very strongly exposed Raman spectra of tetramethyllead, trimethylethyllead, dimethyldiethyllead, methyltriethyllead, tetraethyllead, and completely deuterated tetraethyllead, in the liquid state, were photographed with a three-prism glass spectrograph of linear dispersion 15 Å/mm at 4358 Å. The Raman spectra of a crystalline aggregate of tetramethyllead at -70°C, and of the extremely unstable triethylbismuth in the liquid state at -125°C, were also obtained.

The infrared spectra in the region from 3 to 25 microns

have been obtained for liquid methyltriethyllead, tetraethyllead, and completely deuterated tetraethyllead, with the aid of a Perkin-Elmer Model 112 double pass spectrometer.

The assignments made by previous workers of the fundamental vibrational frequencies for tetramethyllead, assumed to have the symmetry T_d , have been modified and extended as follows: an e fundamental associated with CH_3 rocking was located at approximately 800 cm^{-1} , the species of the two lowest skeletal deformation frequencies were interchanged, and the two CH_3 torsional fundamentals, of the inactive species a_2 and f_1 , were estimated to lie near 215 cm^{-1} . The revised assignments are as follows: species a_1 : 2918, 1169, 462; a_2 : ~ 215 ; e: 2998, 1412, 800, 130; f_2 : 2998, 2918, 1455, 1157, 769, 475, 145; f_1 : (~ 3000), (~ 1450), (750-800), and 215 cm^{-1} . The wave numbers of the inactive fundamentals enclosed in parenthesis are estimated values not supported by spectral evidence.

Because of the complex structure of the other lead alkyls, and the probability that they are subject to rotational isomerism, it has not been possible to make a complete assignment for them. However, their vibrational spectra have been interpreted in some detail on the basis of the idea of "group" frequencies.

A striking feature of the spectra of the lead alkyls is that intense bands, undoubtedly associated with symmetrical CH_3 deformation occurring at 1380 cm^{-1} in the paraffins, are found at very nearly the same wave numbers, 1155 and 1165 cm^{-1} , in all these compounds, with the exception of completely deuterated tetraethyllead where a single intense band is observed at 955 cm^{-1} . This indicates that the perturbing effect of the lead atom upon methyl groups separated from it by a methylene group is practically as strong as upon methyl groups bonded directly to lead.

The correlation of the spectra of $Pb(C_2H_5)_4$ and $Pb(C_2D_5)_4$ is discussed, although the application of the Teller-Redlich product rule is not feasible. Some evidence is presented for the conclusion that tetraethyllead exists in more than one molecular configuration. However, this evidence is not unambiguous.

The writer is indebted to the Ethyl Corporation for the grant of a fellowship and for the samples.

136 pages. \$1.70. Mic 56-562

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X-RAY DIFFRACTION STUDIES OF THE SOLID-LIQUID TRANSITION OF SODIUM

(Publication No. 14,472)

Bernard Andrew Kulp, Ph.D.
The Ohio State University, 1955

X-ray diffraction techniques were used to study the solid-liquid transition of sodium. The intensity of the 110 line of sodium at $2\theta = 29.5^\circ$ for $CuK\alpha$ radiation was used as a measure of the per cent solid content of the sample as the temperature was raised and lowered through the melting point. A proportional counter was used to measure the x-ray intensity. Counting rates upwards of 100,000 per minute were used. The high counting rate enabled accurate readings to be taken in a short period of time. The x-ray tube voltage and current were electronically regulated so that the intensity remained constant for the duration of the experiments within one-half per cent.

After two annealing runs, the intensity remained very constant up to the melting point of the sample. The sample was in the form of small droplets of less than 2 microns (10^{-4} cm .) diameter. The smallest particles melted first, so that the slope of the melting curve changed gradually at first; but after about 30 per cent of the sample had melted, the intensity dropped sharply, and after about 50 per cent had melted, it dropped linearly to the intensity of the liquid diffraction pattern. A particle-size distribution is determined from the melting curve.

The solidification curve was very different from the melting curve. It was marked by several degrees of undercooling. The sample solidified in a way explainable by the application of heterogeneous nucleation theory with the addition of a particle-size effect. It seems to be that the solidification was nucleated by the NaOH layer on the sodium droplets. At a given temperature, there is a limited number of sites available for nucleation, and hence at temperatures below the start of solidification, the transition reaches equilibrium and stops short of completion. It was possible to maintain the sample at various percentages of liquid content for as long as 48 hours without further solidification. This is explained by the fact that at a given temperature, the rate of nucleation is appreciable only for particles of a certain radius or larger. A particle-size distribution is determined from the isothermal solidification data which compares favorably with that found from the melting data.

Two other very important characteristics of the transformation were found. First, the transformation is reversible over part of the range of solid content, namely some 60 per cent solid. There is considerable hysteresis in the reversibility. Second, the transformation exhibits a stabilization effect, i.e., after the temperature has been held constant for a period of time and then lowered, the progress of the transformation lags behind the fall in temperature.

A further study of particle-size effects in the liquid-solid transformation should yield basic information on the mechanism of phase transitions. The use of x-rays to follow the transformation is both convenient and accurate.

151 pages. \$1.89. Mic 56-563

THE ELECTRONIC SPECIFIC HEAT OF TIN-BISMUTH ALLOYS

(Publication No. 13,417)

Elio Passaglia, Ph.D.
University of Pennsylvania, 1955

Supervisor: William F. Love

The specific heat of alloys of three, six, and nine atomic percent bismuth in tin has been measured in the temperature range from 1° K to 5° K. The electronic and lattice contributions to the specific heat have been determined.

The electronic specific heat coefficients has been shown to drop from 4.1×10^{-4} cal. / mole deg.² to 2.5×10^{-4} cal. / mole deg.² between three and six atomic percent bismuth. This has been related to the density of states curve for pure tin which is thereby shown to have an overlapping Brillouin zone structure. These measurements are in accord with similar results previously obtained from superconductivity measurements. Hence the applicability of thermodynamics to the superconductivity of alloys has been demonstrated.

The lattice specific heat has been analyzed on a Debye model. Debye characteristic temperatures agree well with those calculated for the alloys on the basis of additivity of specific heats.

88 pages. \$1.10. Mic 56-564

MEASUREMENT OF THE SPIN PARAMAGNETISM OF CONDUCTION ELECTRONS

(Publication No. 15,263)

Robert Thornton Schumacher, Ph.D.
University of Illinois, 1955

The static magnetic susceptibility of a metal is usually slightly paramagnetic. The principal contributions to χ_p in many cases are a paramagnetic part due to polarization of conduction electron spins, and a diamagnetic contribution due to orbital motion of the conduction electrons and due to ion cores. The high degree of degeneracy of the electron gas makes χ_p small and makes its measurement difficult and sensitive to impurity effects. Unless one can measure one or the other of the two contributions separately, one must depend on a theoretical relationship to determine the contributions of each part. Stimulated by the recent major theoretical advances of Bohm and Pines in treating electrons in metals, this thesis reports a measurement of that part of χ_p arising from the spin polarization alone by studying the conduction electron spin resonance. The results for lithium and sodium are reported.

The spin resonance arises from transitions of the electron spins among the Zeeman levels produced by a static field H_0 . In practice the resonance is plotted at fixed frequency as H_0 is varied through the resonance condition. Our experiment involves essentially the measurement of the total area under the curve of absorption vs. magnetic field H_0 . This area is simply related to the static susceptibility χ_0 in many cases. It is found that the resonant curves of importance for this measurement satisfy the relation

$$1) \quad \chi_0 = -\frac{2\gamma}{\pi\omega} \int_0^\infty \chi'' dH_0.$$

ω is the frequency of the linearly polarized alternating field inducing transitions, γ is the gyromagnetic ratio of an electron, and χ'' is the imaginary or "loss" part of the complex magnetic susceptibility.

The measurement of χ_p involves an absolute intensity measurement and appears difficult at first glance. The essential and new feature of our experiment is the elimination of most of the usual difficulties by comparing the absorption of the electron resonances in the metal with the nuclear resonance in the same metallic sample. We can measure the ratio of the areas under the nuclear and electron absorption curves, and with the use of equation 1 we can relate this ratio to the ratio of the electron and nuclear susceptibilities. Knowledge of the nuclear susceptibility, the ratio of the absorption areas, and the gyromagnetic ratio of the electron and nucleus is all that is needed to determine the electron susceptibility, since circuit parameters and amount of sample cancel out in the ratio. The nuclear susceptibility can, of course, be calculated to a high degree of precision from the Langevin formula.

We obtain for the spin susceptibility of lithium $2.08 \pm 0.1 \times 10^{-6}$ cgs volume units, and for sodium $0.95 \pm 0.1 \times 10^{-6}$ cgs volume units. These values are compared with various theoretical values. Comparison with static measurements enables the calculation of the diamagnetic susceptibility of the spin system. The experimental values obtained are combined with independent measurements of the Knight shift to obtain experimental values for the quantity P_F/P_A for lithium and sodium, and these values are compared to theory. 69 pages. \$1.00. Mic 56-565

PHYSICS, ATOMIC

A REDETERMINATION OF THE HYPERFINE SPLITTING IN THE GROUND STATE OF ATOMIC HYDROGEN

(Publication No. 13,741)

James Pleister Wittke, Ph.D.
Princeton University, 1955

A redetermination has been made of the hyperfine splitting in the ground state of atomic hydrogen, using a microwave absorption technique. A narrow resonance line of ~ 3 kc/sec (1/6 of the normal Doppler breadth) width at half-maximum absorbed power was employed. This was obtained through the mechanism of collision reduction of Doppler breadth proposed by R. H. Dicke. The observed breadth was caused primarily by electron-exchange collisions between hydrogen atoms disturbing the absorption process; some saturation broadening was also present. Other broadening mechanisms, such as natural breadth and broadening due to dipole- and motional magnetic field interactions, were unimportant.

The atomic hydrogen was confined in a glass bottle at the center of a cylindrical copper cavity excited in the TE_{112} mode. The atomic hydrogen was produced in a

Wood's discharge external to the cavity, and was pumped and diffused into the bottle. The total gas pressure in the bottle was ~ 0.1 mm Hg, about 0.16% of which was atomic hydrogen. The bulk of the gas, molecular hydrogen, provided a "buffer" to increase the diffusion time to the wall; because of the paired electron spins in the molecule, electron exchange effects in atom-molecule collisions were negligible.

The microwave power was supplied by a triode oscillator, phase-locked to the sum frequency of a harmonic of a very stable crystal-controlled oscillator and a stable variable-frequency oscillator (~ 433 kc/sec). The crystal-controlled oscillator was compared with WWV to provide an absolute frequency determination. A weak magnetic field of ~ 0.06 gauss parallel to the r.f. magnetic field at the gas sample led to the $\Delta M_F = 0$ hyperfine transition. The direction of this weak field was varied from parallel to nearly perpendicular to the r.f. field at 30 cycles/sec causing a 30-cycle modulation of the absorbed power. The resultant modulated signal was detected in a balanced bolometer mixer, amplified at 30 cycles/sec, and fed into a lock-in amplifier. The locking signal was derived from the 30-cycle magnetic field modulation. A phase-adjustment technique was developed that kept the phase of the signal from the cavity, with respect to the carrier power at the bolometers, adjusted at all times to produce a purely absorptive resonance.

The resonant frequency as measured was shifted slightly by a pressure-dependent mechanism: during a hydrogen atom-molecule collision, the molecular electric fields mix some P state into the atomic wavefunction. As the hyperfine interaction in P states is much weaker than in the 1S state, the result is a reduction in the time-averaged interaction energy, causing a small shift in the measured splitting. The measured shift of about 100 cycles/sec is in agreement with a rough calculation.

The line contour was determined experimentally to be Lorentz shaped. Data were taken by measuring the signal strength at three discrete frequencies on the resonance and fitting a Lorentz curve through the points. The line center was determined from this fitted curve. The results of the measurements, together with the value obtained by extrapolation to zero pressure, are given below:

| Pressure, mm Hg | Number of Observations | Frequency, mc/sec |
|--------------------|---------------------------|--------------------------|
| 0.070 | 35 | 1420.40572 ± 0.00003 |
| 0.088 | 35 | 1420.40575 ± 0.00003 |
| 0.120 | 33 | 1420.40569 ± 0.00002 |
| 0 (extrapolated) | -- | 1420.40581 ± 0.00005 |

The present determination is in disagreement with the value obtained using an atomic beam apparatus, which gave

$$\nu_0 = 1420.4051 \pm 0.0002 \text{ mc/sec.}$$

Both of the above results are in agreement with theory within the uncertainties introduced by high-order radiative corrections and proton structure effects.

148 pages. \$1.85. Mic 56-566

PHYSICS, ELECTRONICS AND ELECTRICITY

FREQUENCY TRANSLATION BY MODULATION OF TRANSIT-TIME DEVICES

(Publication No. 15,362)

Raymond Charles Cumming, Ph.D.
Stanford University, 1955

In several important electronic applications a need arises for a system which will translate, or shift, the frequency of an electrical signal. That is, given an input frequency ω , the system will generate an output frequency $\omega + \Delta\omega$, where $\Delta\omega$ is a predetermined frequency increment.

In general, frequency translation involves a modulation process that serves to generate a number of intermodulation frequency components, called side frequencies. Since the side frequencies are different from the input frequency, one of them can be selected as the desired output signal.

In this dissertation frequency translation systems involving modulation of a transit-time device are considered. A transit-time device is defined as a device in which each cycle of the input signal, or carrier, initiates a disturbance that propagates from the input terminal to the output terminal in a time τ , called the transit time of the disturbance. The transit time τ of a particular disturbance is determined by conditions that exist at the time the disturbance departs from the input terminal. Microwave electronic examples of a transit-time device so defined are the klystron and the traveling-wave tube.

In the general case, modulation of transit-time devices results in both transit-time modulation (TTM) and amplitude modulation (AM). A spectrum analysis of the output amplitude of a transit-time device which is simultaneously modulated by general periodic waveforms of TTM and AM is presented. It is shown that the general results are similar to but have important differences from the results of an analysis of combined phase modulation (PM) and AM.

The general spectrum analysis is applied to the often-used conventional system which employs TTM by a sinusoidal modulating waveform. It is found that this conventional system produces a frequency-translated power output which is at least 4.7 db less than the power output that would be obtained from the same transit-time device in ordinary unmodulated operation. In addition, it is seen that the amplitudes of the undesired side-frequency components in the vicinity of the desired component are equal to or of the same order of magnitude as the amplitude of the desired component itself. This means that a selective filter must be used to pass the desired component to the output while blocking the undesired components.

A new frequency translation system which overcomes the shortcomings of the conventional system is proposed and analyzed. The new system employs TTM by a linear sawtooth modulating waveform and is accordingly given the name "serrodyne," from the Latin word "serra," which means "saw" or "sawtooth." When the general spectrum analysis is applied to this new system, it is found that the frequency-translated power output approaches equality with that which would be obtained from the same transit-time device in ordinary unmodulated operation. Furthermore, it is seen that the modulation process itself greatly

suppresses the amplitudes of all undesired frequency components, thus reducing or eliminating the need for a selective filter at the output. The above features give the serrodyne extremely important advantages over the conventional frequency translation system in a number of important applications.

The theoretical limits to the performance of serrodyne systems are shown to be set principally by two things: (1) the finite flyback time of realizable sawtooth modulating waveforms, and (2) the presence of AM effects which accompany the application of TTM to a physical transit-time device.

The results of preliminary experiments with the serrodyne system using a sawtooth modulated traveling-wave tube (one-watt, S-band, Stanford T-301) are given as follows: with a 2 Mc/s modulating wave, practically 0 db translation loss, and 23 db suppression of undesired frequency components; with a 30 Mc/s modulating wave, approximately 2 db and 12 db, respectively.

An appendix is devoted to the problem of the generation of high-frequency (of the order of 30 Mc/s) sawtooth voltage waves.

Another appendix presents a derivation of the variation of transit time and amplitude gain to be expected from variations of beam voltage and beam current in klystrons and traveling-wave tubes. The derivation for the traveling-wave tube is quite general, and holds for finite values of all the parameters, b , C , QC , and d .

134 pages. \$1.68. Mic 56-567

CHEMISORPTION, PHOTOCONDUCTIVITY, AND PHOTODESORPTION IN ZINC OXIDE

(Publication No. 13,411)

David B. Medved, Ph.D.
University of Pennsylvania, 1955

Supervisor: Park Hays Miller, Jr.

Photoconductivity processes in zinc oxide are studied in detail at room temperature as a function of time, incident light intensity, and pressure. The experiments are performed on very thin (0.001") samples of sintered ZnO. The results are in essential agreement with the theory of chemisorption and conductivity developed by Morrison and Melnick.

At high levels of illumination it was found that:

1) The rise of photoconductivity in thin samples reaches saturation in several minutes or seconds (dependent on incident intensity) while it increases indefinitely in thick samples.

2) Ambient pressure in the region of 10^{-6} mm shows a definite monotonic increase when the sample is irradiated. This indicates that the incident light causes a photodesorption of gas from the surface concomitant with the increase in conductivity.

At low levels of illumination, (corresponding to changes in the conductivity of 10 per cent or less) the results show that:

3) The rates of rise and decay follow kinetics involving an expression of the Elovich type as predicted by Melnick.

4) The variation of the saturation photoconductivity with intensity is essentially logarithmic.

Using a simple model, a theoretical formulation is developed for the equilibrium (dark) concentration of conduction electrons as a function of temperature and pressure in a system composed of completely ionized donor levels and a set of surface acceptor sites in equilibrium with ambient atmosphere. A careful analysis of the decay process indicates that the failure of the theory for high level illumination is due to influence of decreasing conduction electron concentrations. Equations are developed which show that the Elovich-Melnick equation for photoconductivity decay is the zero-order term of a more general expression. Agreement of experimental results for low-level illumination and the theory is demonstrated.

115 pages. \$1.44. Mic 56-568

PHYSICS, METEOROLOGY

SOME PHYSICAL FACTORS OF MICROCLIMATES AND THEIR USE IN TEACHING WEATHER AND ECOLOGY

(Publication No. 15,528)

Verne Norton Rockcastle, Ph.D.
Cornell University, 1955

This study involves an attempt to show by experiment and observation that some physical factors of microclimates can be studied by school children in a way that will make concrete on a small scale what they learn in an abstract way about weather, climate, and ecology on a large scale.

Heat exchange and air movement were the two major subjects of investigation. Radiation - the least understood method of heat transfer - was investigated through its effect on the formation and dissipation of frost crystals and the melting of snow. Small, rectangular plates of wood and metal, some blackened and some polished, were exposed to solar and terrestrial radiation. The black plates melted snow faster in the day and produced frost more quickly at night than did the polished ones. Insulated objects were found to frost more quickly than those in contact with the ground.

Surface configuration and orientation were found to affect the temperatures produced by insolation and extermination. Convex surfaces such as leaf veins frosted sooner and more heavily than equally concave surfaces. The slopes of tiny depressions in the ground were found to have climates similar to large valley slopes.

Radiation shadows were shown to be cast by many opaque objects. Visible shadows were observed to coincide with frost outlines on roofs and on the ground. Radiation ceilings were found to be provided by various coverings from leaves to clouds. The speed with which clouds blocked outgoing radiation provided a direct observation of the speed with which radiant energy travels.

A series of feathervanes arranged vertically, six inches apart, was used to study the direction of air movement near the surface. Bubbles, smoke, and air-borne seeds were used to measure velocity. All the equipment used in the study was assembled in a readily portable Kleinklima Kit to facilitate field studies.

The ecological relationships of some microclimatic factors were shown in a simple study of four neighboring habitats: that of the Carolina grasshopper, the toad tadpole, the field mouse, and the red-backed salamander. Temperature studies with maximum-minimum thermometers showed that some of the so-called cold-blooded animals live in climates which are so cold at night and so hot during the day that they approach desert conditions. Others live in a very stable environment. Both climates are often situated within a few feet of each other. Throughout the study an attempt was made to show the complexity and variability of the climate near the ground, some of the factors that control it, and some of the conditions imposed on the plants and animals associated with it.

In conclusion, the study of microclimates provides a direct-experience approach to the understanding of macroclimates. In a small area one can study first-hand the very factors which control continental weather. The simplest of equipment can show qualitatively many effects of the heat exchange and air currents which control the climate. To study, even qualitatively, the physical factors of these microclimates, together with their associated biota, will almost certainly lead to new appreciations and understandings of the complex little worlds at our feet. It will provide a sound background of direct experiences for the abstractions which must of necessity follow in any advanced study. 139 pages. \$1.74. Mic 56-569

PHYSICS, NUCLEAR

PHOTONUCLEAR CROSS SECTION OF OXYGEN

(Publication No. 15,254)

Alan Scardeburg Penfold, Ph.D.
University of Illinois, 1955

The 22 Mev. betatron at the University of Illinois has been used to make a careful survey of the $O^{16}(\gamma, n)O^{15}$ yield curve over a large portion of the energy region between 15.6 Mev. and 23 Mev. The reaction was detected by counting the positron activity in the product nucleus. A point on the yield curve was obtained every 10 to 15 Kev. over most of the energy region covered, and each section of the curve was determined on at least two occasions.

Fine structure, in the form of sudden changes of slope of the yield curve, was observed. In all, twenty-five of these "breaks" were resolved. The average frequency of the breaks was five per Mev.

The existence of these "breaks" had been previously reported by workers at the University of Saskatchewan,¹ and the present work constitutes the first independent verification of their existence. However, more breaks were resolved in the present work than in the previous work.¹

The breaks were interpreted as manifestations of narrow resonances in the $O^{16}(\gamma, n)O^{15}$ cross section. This interpretation was substantiated by the concave down nature of the yield curve between breaks, by a detailed cross section analysis of one of the breaks, by a 100 Kev. step cross section analysis of the yield curve up to 18 Mev., and by an absorption experiment.

A detailed cross section analysis of the yield curve in the vicinity of a break at 16.00 Mev. indicated the presence of a narrow resonance in the cross section. The resonance had a width of 18 Kev., a peak height of 1.4 millibarns, and an integrated cross section of 0.04 millibarns-Mev. This information, together with a comparison of relative break-strengths, served to fix the integrated cross sections for all the observed levels. The integrated cross sections increased greatly in the vicinity of the "giant resonance" of the cross section. The results indicated that the bulk of the gamma-neutron cross section in oxygen is contained in narrow resonances.

Calculations with test cross sections indicated that all the observed breaks were caused by levels narrower than 70 Kev. The peak heights of the levels were computed by assuming a level width of 25 Kev. for all.

An estimate of the radiative widths indicated that the levels below 19 Mev. are likely reached by electric quadrupole or magnetic dipole transitions. On the other hand, the levels in the vicinity of 23 Mev. are likely reached by electric dipole transitions. 127 pages. \$1.59. Mic 56-570

I. L. Katz, R. N. H. Haslam, R. J. Horsley, A. G. W. Cameron and R. Montalbetti, *Phys. Rev.* **95**, 464 (1954).

STUDY OF MOMENTUM SPACE INTEGRAL EQUATIONS

(Publication No. 15,432)

Mosur Kalyanaraman Sundaresan, Ph.D.
Cornell University, 1955

The integral equation for the scattering of neutrons by protons in the singlet state at zero energy is established in the lowest order Tamm-Dancoff approximation to the symmetric pseudoscalar meson theory in momentum space. The kernel of this equation is found to be an always positive of both of its arguments. Similar kernels have been encountered in the lowest order Tamm-Dancoff approximation to the π -meson-nucleon scattering (1) and it was shown there that a positive kernel corresponds to a repulsive interaction while a negative kernel corresponds to an attractive interaction. Thus it would appear that in the singlet state of the neutron-proton scattering the interaction is repulsive. On the other hand, Lévy (2) has established that the interaction in the singlet state reduces to an ordinary potential which is attractive for non-relativistic nucleons. The problem at hand is to reconcile these two results. It appears that, while a negative kernel always implies attraction, a positive one does not necessarily imply repulsion, but that it is necessary to investigate its detailed behaviour.

To study this problem we have constructed model integral equations in momentum space possessing as many of the relevant features of our equation as possible. The kernels of our model equations are Fourier transforms of certain potentials in coordinate space for which the Schrödinger equation in coordinate space is exactly soluble. The potentials in coordinate space chosen were the purely repulsive exponential potential and the Morse potential, the latter being chosen owing to its similarity with the Lévy potential. By suitable choice of the parameters of the

Morse potential, the kernel corresponding to it can be made an always positive function of both of its arguments. Study of the detailed behaviour of the kernels in these two cases shows that the kernel corresponding to the Morse potential, possesses a maximum for some small value of both of its arguments. This difference in behaviour for small momenta is attributed to the existence of long range attraction in the Morse potential. Solution of the integral equations numerically, obtaining the behaviour of the scattering length as a function of the depth parameter of the potential, also reveals the existence of long range attractive forces in the Morse potential, manifesting itself as a resonance in the scattering for some value of the depth parameter. Similar criteria applied to the Tamm-Dancoff integral equation reveal the existence of attractive forces, and the numerical value for the scattering length as a function of $G^2/4\pi$, presents definite evidence for a repulsive core of radius $\tau_c = 0.4 \frac{1}{\mu}$ to $0.5 \frac{1}{\mu}$, the range of the attractive part of the forces being $1/\mu$, the π -meson Compton wave length.

The model integral equations possess formal Fredholm solutions whereas the Tamm-Dancoff equation does not. The Tamm-Dancoff equation is a singular integral equation. This makes the high momentum behaviour of the two equations quite different, and to investigate this two simple singular integral equations are constructed and studied.

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131 pages. \$1.64. Mic 56-571

GAMMA RAY INDUCED ISOMERS WITH HALFLIVES BETWEEN TEN MICROSECONDS AND ONE TENTH OF A SECOND

(Publication No. 15,285)

Stanley Henry Vegors, Jr., Ph.D.
University of Illinois, 1955

The development of a technique for the detection of radioactivity between the x-ray yield pulses from the University of Illinois 22 Mev betatron, and its application to the measurement of radioactivities in the halflife range from approximately 10 microseconds to one tenth of a second is discussed. The validity of this approach is investigated by observing the known isomeric transitions in this range of halflives in Pb^{206m} , Zn^{67m} , Ta^{181m} , and Y^{88m} . A search is undertaken to determine whether any previously undetected isomers exist in this range of halflives.

Twenty-two elements are investigated, and previously unreported activities are found in As, 315 kev, $\approx 14 \times 10^{-3}$ sec.; Mo, 98 kev, 16.5×10^{-6} sec.; Pd, 160 and 300 kev, 33×10^{-6} sec.; W, 370 kev, 16×10^{-6} sec.; Tl, 410 kev and 720 kev, 65×10^{-6} sec.; Tl, 520 kev, 5.3×10^{-4} sec.; and Bi, 545 kev and 1.065 Mev, $\approx 5 \times 10^{-3}$ sec. The (γ, n) thresholds for the production of Pb^{206m} , Pb^{207m} , Y^{88m} , and the 16.5×10^{-6} sec. Mo are also measured. 139 pages. \$1.74. Mic 56-572

CONDUCTION MECHANISMS IN SMOOTH
MUSCLE AS REVEALED BY A
COMPARATIVE HISTOLOGICAL STUDY

(Publication No. 15,186)

Ronald Arly Bergman, Ph.D.
University of Illinois, 1955

A comparative histological investigation of the smooth muscle from the cat intestine, rat ureter, and the proboscis retractor muscle of *Phascolosoma gouldii* was undertaken so that prior contradictory electrophysiological and pharmacological evidence concerning conduction mechanisms might be clarified by structural considerations. The use of the electron microscope has revealed that the smooth muscle cells studied are clearly bounded by a cell membrane or sarcolemma. The cell membrane in the intestinal and ureteral smooth muscle is approximately 280 to 300 A thick and may be a double structure, while in the retractor muscle cell membrane it is 190 A thick and is single. In the smooth muscle of the cat intestine and rat ureter, but not in the *Phascolosoma* retractor, intercellular anastomoses were found. These anastomoses are not regarded as true protoplasmic bridges, since in the region of the intercellular anastomoses, membranes of adjacent cells are intact and prevent intercellular sarcoplasmic or fibrillar continuity. Since there is intercellular membrane continuity, but not sarcoplasmic continuity between adjacent cells these muscles can be considered neither as a true syncytium nor as discrete cells. In the ureter, cell membranes are often closely opposed for long distances. Conduction from cell to cell is postulated as occurring by intercellular membrane anastomoses which may have low electrical resistance; in addition an ephaptic component may play some role in conduction. Because the intestinal and ureteral muscle cells do not form a true syncytium the reported low injury potential is explained and since the muscle cells are approximately 23 times larger than the intercellular anastomoses, a delay of the conducted action current in these areas would account for the low velocity of propagation reported in visceral smooth muscle. In the retractor muscle, but not in the mammalian muscle cells, intracellular nerve endings were found. The identification of intracellular nerve endings in the retractor muscle supports the electrophysiological evidence previously reported that conduction in this muscle is nervous.

Intimately associated with the cell membrane of the intestinal and ureteral muscle cell are found border fibrils which traverse the long axis of the cell. In cross section the border fibrils are 150 to 300 m μ by 60 to 120 m μ . Similar structures were not found in the proboscis retractor muscle. The sarcoplasm of the intestinal and ureteral cell is of two sorts, an outer fibrillar area and a central granular core; myofilaments 100 to 130 A thick can be distinguished in the fibrillar sarcoplasm. Mitochondria are sparsely distributed throughout the fibrillar sarcoplasmic matrix and are abundant in the granular sarcoplasm. In the granular sarcoplasm are found small particulate components 140 to

720 A in diameter. A granular sarcoplasm is not found in the proboscis retractor muscle cell. In the fibrillar sarcoplasm of the mammalian muscle cell are found elongated, dark-staining structures of unknown character.

The sarcoplasm of the proboscis retractor muscle cell may appear homogeneous, moderately fibrillar, or extremely fibrillar; the myofilaments are approximately 150 A thick. Located in the moderately fibrillar sarcoplasm elongated tapered striated bodies 5000 to 15000 A in length and 1000 A wide are found. The individual striations are 250 A wide and are spaced 1000 A apart. No structures corresponding to mitochondria have been recognized in the retractor muscle cell. The cell nuclei are prominently located in the central portion of the cell in the intestinal and ureteral muscle while in the retractor muscle they may be either centrally or eccentrically located between the cell membrane and sarcoplasm.

144 pages. \$1.80. Mic 56-573

PHYSIOLOGICAL RESPONSES OF
THREE NUTRITIONALLY DIVERSE
DIPTEROUS INSECTS TO SELECTED
CARBOHYDRATES

(Publication No. 15,208)

Rachel Galun, Ph.D.
University of Illinois, 1955

The utilization of 29 carbohydrates by three species of Diptera, *Aedes aegypti* (Linn.), *Sarcophaga bullata* (Park.) and *Musca domestica* (Linn.) was investigated.

The following carbohydrates were utilized by the adults as determined by survival:

Aedes aegypti

Well utilized were: glucose, fructose, sucrose, maltose, raffinose, melezitose, and sorbitol.

Utilized to a lesser degree were: galactose, trehalose, melibiose, and dextrin.

Not utilized at all were: xylose, ribose, arabinose, rhamnose, mannose, sorbose, cellobiose, lactose, starch, glycogen, inulin, α -methyl glucoside, α -methyl mannoside, glycerol, mannitol, dulcitol, and inositol.

Sarcophaga bullata

Well utilized were: glucose, fructose, mannose, galactose, sucrose, maltose, trehalose, raffinose, melezitose, dextrin, α -methyl glucoside, mannitol and sorbitol.

Utilized to a lesser degree were: melibiose, starch, glycogen, glycerol, and inositol.

Not utilized at all were: xylose, arabinose, ribose, rhamnose, sorbose, lactose, cellobiose, inulin, α -methyl mannoside and dulcitol.

Musca domestica

Well utilized were: glucose, fructose, mannose, galactose, sucrose, maltose, trehalose, melibiose, lactose, raffinose, melezitose, dextrin, starch, glycogen, mannitol, and sorbitol.

Utilized to a lesser degree were: α -methyl glucoside, glycerol, and inositol.

Not utilized at all were: xylose, arabinose, ribose, sorbose, cellobiose, inulin, α -methyl mannoside and dulcitol.

The presence of the carbohydrases necessary for hydrolysis of all the utilized glycosides, oligo- and polysaccharides, with the exception of melibiase and lactase, was demonstrated in the adult insects. Larvae of *Sarcophaga* and house fly were shown to possess only invertase, and to acquire the other carbohydrates during the pupal stage.

Attempts were made to distinguish between inert, toxic, and repellent substances. Xylose, arabinose, ribose, rhamnose, sorbose, α -methyl mannoside and inositol were found to have a strong repellent effect on the house fly, and in addition to be also toxic. Some of these compounds were found to be toxic and/or repelling also for *Aedes aegypti* and *Sarcophaga bullata*.

Xylose and arabinose were found to be rejected by the mouthparts of *Phormia regina* (Meig.) at concentrations even lower than those accepted by the tarsi.

92 pages. \$1.15. Mic 56-574

ADRENAL CORTICAL FUNCTION AS ASSESSED BY 17-HYDROXYCORTICOSTEROID LEVELS IN THE PLASMA OF DAIRY CATTLE

(Publication No. 14,054)

William George Robertson, Ph.D.
Rutgers University, 1955

This investigation deals with the development of a method for the extraction, purification, and chemical assay of 17-hydroxycorticosteroids in the plasma of dairy cattle and the application of such a method for interpretation of adrenal cortical function in various physiological states.

A method was developed whereby plasma 17-hydroxycorticosteroids could be determined. This involved the extraction of chilled plasma with cold ethyl acetate, washing the extract with a saturated sodium solution, 0.1N sodium hydroxide, and distilled water. The extract was then dried over anhydrous sodium sulfate. It was next reduced to dryness with the aid of a gentle stream of air in a water bath maintained at 50 degrees C. The residue was partitioned between 80 per cent methanol and hexane and the hexane was discarded. Aliquots of the methanol phase containing 20 to 30 ml. of plasma equivalents were assayed by a 1.0 ml. micro modification of the phenylhydrazine reaction. The sensitivity of the color reaction was such that 2 micrograms of 17-hydroxycorticosterone could be detected with a relative analysis error of 5 per cent or less.

The physiological significance of the fraction assayed was examined by determining its response to intramuscular injections of ACTH. Jugular vein blood samples were obtained from six cows and immediately following they were

injected with 600 Armour Veterinary Units of ACTH intramuscularly. Two hours later another blood sample was obtained. Plasma 17-hydroxycorticosteroid levels showed an 120 per cent mean increase in two hours.

Recovery experiments were conducted in which 17-hydroxycorticosterone was added to plasma and recovery calculated. The amount of added material ranged from 17.5 to 5.0 micrograms per cent. Recovery ranged from 77.0 to 84.9 per cent in 8 experiments with a mean recovery of 81.0 per cent.

In an effort to establish normal ranges for plasma 17-hydroxycorticosteroids, animals in various physiological states were studied. Dry, pregnant animals within the six week period prior to parturition had a mean plasma 17-hydroxycorticosteroid level of 9.77 micrograms per cent. Milking, non-pregnant cattle in the six week period following parturition had a mean plasma 17-hydroxycorticosteroid level of 4.58 micrograms per cent. The two levels were significantly different.

The syndrome ketosis was studied to determine whether an adrenal insufficiency was involved. Blood samples were obtained from ketotic animals and a normal control. The control was selected to conform as closely as possible to the ketotic animal in regard to age, time since parturition, level of lactation, and breed. Plasma protein-bound iodine, blood sugar, blood acetone, and plasma 17-hydroxycorticosteroids were determined in ten normal-ketosis pairs. The ketotic animals evidenced a markedly lowered thyroid activity, as determined by plasma protein-bound iodine levels, accompanied by an increased plasma 17-hydroxycorticosteroid level when compared to the normal controls. The implication that ketosis was accompanied by a relative adrenal insufficiency mediated through the thyroid gland was pronounced. In the opinion of the writer the higher blood steroid levels reflected a lowered rate of tissue utilization.

Since ketosis has been defined in terms of the general adaptation syndrome and believed to be precipitated by the stress of parturition and increased milk production, interest was focused on the response of the dairy cow to other acute conditions. Blood samples were obtained from ten animals suffering from various acute conditions other than ketosis. Blood steroid levels in these animals showed a three fold increase over normal controls accompanied by a normal or above normal thyroid gland activity. This was in marked contrast to the results obtained in ketotic animals.

The general conclusions reached were that the method presented was a reliable means of assessing adrenal cortical function in a variety of conditions. In addition it appeared that ketosis was the result of a relative adrenal insufficiency mediated through the thyroid gland and the response to this particular stress condition was unlike that obtained in a variety of other acute conditions as reflected by blood steroid levels and plasma protein-bound iodine levels.

144 pages. \$1.80. Mic 56-575

**TOXINS OTHER THAN DDT IN THE
BLOOD OF DDT-POISONED
PERIPLANETA AND LIMULUS**

(Publication No. 15,266)

Daniel Leslie Shankland, Ph.D.
University of Illinois, 1955

A study was made of the toxic principle found in the blood of DDT-poisoned American roaches which was first reported by Sternburg and Kearns (1952)*.

The presence of toxin in the blood can be detected by observing the effects of the blood in question on the spontaneous activity of excised roach nerve cords. The principle is neurotoxic in that it causes slight to marked increases in spontaneous nervous activity. As the concentration of the toxin becomes greater, it causes increasingly violent responses from excised cords, to a point, after which it has a tendency to suppress, or, in very high concentrations to abolish activity entirely.

A correlation was shown to exist between the concentration of toxin in the blood of DDT-poisoned roaches and their symptoms of poisoning. As the stages of poisoning progressed from a state of hyperexcitability, through periods of tremors and convulsions, to prostration and complete inactivity, the toxin content of the blood increased.

A study of the effect of the toxic blood on the responses of excised cords to faradic stimulation revealed that the toxin has a site of action on synapses. It caused the appearance of after-discharges in the giant fibers as a result of a single faradic stimulus to the cercal nerve. It also caused, depending on its concentration, a lowered threshold for trans-synaptic conduction from the cercal nerve to giant fibers, or synaptic blocks, rendering excised nerves completely refractory to cercal nerve stimulation.

It was found that the toxin can be dialyzed out of blood, and that it can be recovered in the dialysate. In blood it is unstable at room temperature, while in the dialysate it is not only stable at room temperature, but is also stable at a temperature of 100 degrees C. maintained for a period of 10 minutes.

Temperature had an effect on the toxins action on cords, in that samples of blood which caused the appearance of spontaneous activity in giant fibers at 28 degrees C. only rarely had such an effect at temperatures higher than 30 degrees C.

There was a difference between the ultra violet absorption spectra of the dialysates of normal and toxic blood. The dialysates of normal blood had a peak of absorption between 280 and 285 millimicrons, while those of toxic blood had a peak at 270 millimicrons.

A toxin was found in the blood of DDT-poisoned Limulus polyphemus which had properties similar to those of the roach toxin, except that it was stable in blood at room temperature.

It was concluded that the toxin found in the blood of DDT-poisoned roaches is dialyzable and non-protein in nature, and requires no non-dialyzable co-factor. It was further concluded that it has a site of action on synapses. The possibility that the toxic effects of blood is due to an alteration in the concentrations of calcium or potassium ions was discussed, and the conclusion was drawn that such a hypothesis is untenable. 59 pages. \$1.00. Mic 56-576

*Sternburg, J., and C. W. Kearns. 1952. The presence of toxins other than DDT in the blood of DDT-poisoned roaches. Science 116: 144-147.

**EFFECTS OF THE REMOVAL OF THE
POSTERIOR PITUITARY AND OF
RESECTION OF THE PITUITARY STALK
IN CHICKENS**

(Publication No. 15,268)

Herschel Vincent Shirley, Jr., Ph.D.
University of Illinois, 1955

In this series of experiments on chickens the removal of the posterior lobe of the pituitary caused no significant difference in their growth rate, the amount of feed consumed, nor the weights of the thyroids, adrenals, ovary or oviduct. No difference was found in hematocrit determinations as compared to control birds. After the recovery from the stress of the operation, oviposition and the intensity of egg laying was apparently unaffected.

The removal of the posterior lobe was found to result in a significant increase in the number of red blood cells per mm³, and in the development of a marked polydipsia and polyuria. Pitressin was effective in reducing the polyuria. Repeated injections of pitressin was found to result in a refractiveness to its antidiuretic effect.

The effect of hypophyseal stalk section on anterior pituitary function and morphology was studied in the domestic chicken. The operated hens were, following post-mortem examination, placed in three groups on the basis of the location of the plastic piece used to cut the stalk and to prevent its regeneration. They are: (A) complete stalk sectioned (B) small portion of anterior lobe retaining its portal connections and (C) plastic piece embedded in the anterior lobe.

Complete severance of the pituitary tissue from its hypophyseal portal system (Groups A and B) resulted in its anemic infarction, gonadal atrophy and hence decrease in comb size. Hens of Group C returned to normal egg production following the attempted stalk section. Examination of the thyroid and adrenal tissues of the three groups revealed no apparent difference in their histology.

It is concluded that stalk section in the domestic chicken inhibits secretion of the gonadotrophic complex of the pituitary gland leading to gonadal atrophy. Whether this is the result of anemic infarction and/or the lack of a neural or humoral stimulus from the hypothalamus is not known.

57 pages. \$1.00. Mic 56-577

POLITICAL SCIENCE, GENERAL

THE FLORIDA SUPREME COURT: A
STUDY IN JUDICIAL SELECTION

(Publication No. 15,182)

Emmett Wilfort Bashful, Ph.D.
University of Illinois, 1955

The Supreme Court of the state of Florida is composed of seven justices who are selected for terms of six years. This study is an attempt to show how these justices are selected and to describe and analyze the factors influencing the selection process. It is concerned primarily with those justices who were on the court from January, 1943 to December, 1954.

There are two methods provided in the Florida Constitution for selecting Supreme Court Justices. The first vests the selection of judges in the qualified voters of the state. A second method was provided by which the governor filled vacancies caused by the death, resignation or retirement of a justice before the end of his term through executive appointment. These appointees serve until the election and qualification of a successor at the next ensuing general election. Since Florida is a one-party state, the actual selection takes place in the Democratic primary. The first was to be the principal method of selection and the second a subsidiary or contingent one.

Since 1926 there have been eight contests in which candidates have waged campaigns in a primary for nomination to a place on the court. All of these campaigns were held during the period covered by this study. Three were in 1938, one each in the years 1942, 1946 and 1948 and two in 1952. Therefore, since 1926 the qualified electors had only eight chances to cast their ballots to select a Supreme Court justice. If there had been opposition to the incumbent in each primary after the expiration of a term of office, there would have been at least thirty-three contests. But this lack of opposition reduced the number of contests to eight. A study of these campaigns reveals the type of campaign conducted in judicial elections, the issues presented, the extent of voter participation and the influence of interest groups in the selection process.

Since 1885 only nine of the thirty-one justices who have served on the Supreme Court of Florida came on the court initially through election to that tribunal. The other twenty-three reached the court through gubernatorial appointment. Of the twelve justices examined in this study only three were elected on their original entry on the court. Nine were appointed by the governor. Thus, a large majority of the justices came to the court by the method of selection given secondary emphasis in the constitution and statutes while a minority of the justices entered the court initially through the method of selection given primary emphasis.

Persons who came to the court initially through interim appointments have been regularly returned to office through renomination and reelection after such appointment. These

appointees and other incumbents are usually nominated without opposition in the party primary and rarely face opposition in the general election.

The combination of interim appointments and unopposed nominations has so modified the process by which Supreme Court Justices are selected that, despite the formal constitutional and statutory provisions, it is no longer an elective system in practice. In actual operation, the system is, principally, an appointive one. Although the electorate may exercise a check on the governor's appointment in the next primary following such appointment — if there is a candidate opposing the appointee — it usually ratifies the governor's selection by returning his appointee to office. In only one case since 1885, when the present constitution was adopted, has a recipient of an interim appointment been defeated for reelection and in that case he had already served fourteen years on the bench of the high court before his defeat. None of the twelve judges who were the principal subjects of this study was ever defeated for reelection. Incumbents desiring further service on the bench were regularly nominated for another term.

255 pages. \$3.19. Mic 56-578

PROBLEMS OF A SENATOR: A STUDY
OF LEGISLATIVE BEHAVIOR

(Publication No. 15,130)

Charles E. Gilbert, Ph.D.
Northwestern University, 1955

This study focuses on the legislative behavior of one United States Senator chiefly during the Eighty-third Congress. The material of the study comes chiefly from observation, participation (as a member of the Senator's staff) and interviews, supplemented by documentary sources where possible and appropriate. The writer has tried to exercise caution in generalizing, and particularly in extending generalizations concerning one Senator to others or to the political system as a whole, though he has hoped that intensive study of one Senator interacting with other forces in and around Congress would shed light on Congress as a whole and provide new suggestions for research.

The study consists of two major efforts: (1) to isolate and describe the major group affiliations of the Senator and his relationships with them; and (2) to evaluate the influence of these affiliations upon the Senator's behavior.

The major group affiliations are identified as follows: (1) the United States Senate, (2) committees of the Senate, (3) the Senate Democratic party, (4) the more or less formally organized "liberal" wing of this party, (5) a group of personal friends in the Senate. (6) Four major constituency affiliations are identified, though it is stressed that these are not the sole affiliations of the Senator and that dealing with organized groups *qua* groups does not exhaust the Senator's politics. The four constituency groups (not

entirely limited to the state constituency) are (1) most of organized labor, (2) the Farmers' Union, (3) small businessmen, and (4) those people politically interested in civil-rights and antidiscriminatory legislation. Groups three and four are significantly less tightly organized than the others. Finally, the state political party is a chief basis of electoral strength.

Some evaluation of influences is attempted quantitatively (through examining roll-call votes); in some cases it can only be done descriptively. In several instances case-studies of decisions on how to vote on particular issues are used to point to the influences and how they are exerted. The utility of roll-call vote analyses is discussed, three main conclusions being that (1) much important legislation never receives a roll-call, (2) roll-call analyses cannot show the dynamics of a decision, and (3) the chief use of roll-call analyses is in getting at constituency influences rather than Senate influences.

The influence of the Senate as a whole upon a Senator's behavior during his first term is historically described. The tentative conclusion is that the norms of the Senate had a marked effect in modifying behavior and tactics in line with Senate conventions. The importance of standing by obligations incurred through committee membership is demonstrated by case-studies. The influence of the (minority) Democratic party is examined and all the findings, so far as roll-call votes are concerned, confirm the findings of previous studies on the laxness of party discipline. The Senator's voting is found to conform closely to that of the majority of his liberal wing of the party. The influence of this liberal wing cannot be isolated quantitatively, but the nature of the influence is discussed in some detail. Personal friendship is tentatively found not to influence roll-call voting, save in isolated cases, though it does influence general outlook.

Constituency groups are shown to prevail over non-constituency affiliations in all cases of clear opposition during the Eighty-third Congress, and in most earlier cases. Case-studies of these instances are drawn in detail. Yet, constituency influences and friendship and liberal affiliations in the Senate are rarely opposed, leading to the conclusion that the Senator generally maintains high consistency within his own political system. Descriptive material attempts to explain how this is managed.

407 pages. \$5.09. Mic 56-579

REPUBLICAN FOREIGN POLICY, 1939-1952

(Publication No. 15,210)

Charles John Graham, Ph.D.
University of Illinois, 1955

In 1939 the Republican party in Congress was not only overwhelmingly opposed to the foreign policy of the Roosevelt Administration and determined that the United States should not intervene in the wars or politics of Europe and Asia, but also had developed a philosophy of isolationism to which nearly all Republican Senators and Representatives subscribed. In 1952 the Congressional party was nearly as unified in its opposition to the Administration's handling of foreign affairs, but did not oppose all intervention in world

politics, and had almost completely abandoned its philosophy of non-intervention or isolation. This dissertation deals with the development of Republican foreign policy between those years in terms of personalities, organization, and party declarations of principle. It further attempts to delineate by an analysis of voting in Congress the trends in the party's foreign policy during this period.

Pearl Harbor administered the shock which undoubtedly began the process of change in Republican thinking, and by the time of the famous Mackinac Conference in 1943, even the Congressional party was clearly committed to supporting United States participation in postwar international organization. Outside Congress Republican Governors, the National Committee, and the party's presidential nominees, representing different Republican groups, moved faster toward an internationalist position than did the party leadership in House and Senate. Even after the Congressional party had accepted the United Nations and other related organizations, there was hesitation on its part to go much beyond this in committing the United States to an active role in international politics — especially if this meant the expenditure of large sums of money such as were represented in the British Loan of 1946.

In the Republican 80th Congress, however, under the leadership of the former isolationist, Senator Arthur Vandenberg, those members in both houses which were not only internationalist but were disposed to follow the Administration (or in some cases, bipartisan) formula for foreign policy, were able to claim the support of a majority of their colleagues. Thus Senator Vandenberg and others, working in close conjunction with the Department of State, were able to assure comfortable Republican, as well as Congressional, majorities for aid to Greece and Turkey, the European Recovery Program, the Vandenberg Resolution, and other measures representing broad commitments for this country in world affairs.

Following the surprising Democratic victory of 1948, a combination of causes and events worked to produce a changed attitude on the part of a majority of the Congressional party. The defeat of Dewey, who had supported the bipartisan approach to foreign policy, the illness and death of Senator Vandenberg, and a seemingly less cooperative and more independent attitude on the part of the Administration were some of these circumstances. By 1950 the working arrangements which had made bipartisan foreign policy legislation possible had come to an end, and those Republicans who wanted to continue to support the Administration line, even without these arrangements, were reduced to a small minority in both houses. The party turned to increasingly bitter attacks on the Administration's handling of foreign affairs, especially with respect to the Far East. Support for economic assistance to Europe dropped off sharply, and that for military aid to Europe declined somewhat, although few Republicans would have favored withdrawing from Western Europe. By contrast, Republican demands for increased aid to Asia became more insistent and criticism of the Administration's foreign policy in the Far East was for too little rather than too much active intervention against expanding communism. Thus while returning to a position of almost complete opposition to the Administration such as was found before World War II, the Republicans did not return to a philosophy of isolation.

334 pages. \$4.18. Mic 56-580

THE DEVELOPMENT OF THE CONCEPT OF LIBERTY IN THE FOURTEENTH AMENDMENT

(Publication No. 15,239)

Eugene Alberto Mawhinney, Ph.D.
University of Illinois, 1955

Since 1868 the justices of the United States Supreme Court have carried the concept of liberty in the Fourteenth Amendment far from the ascertainable intent of the Amendment's framers. The purpose of this thesis was to trace the Supreme Court's development of that "liberty" which may not be deprived by a state without due process of law.

As far as may be ascertained from Congressional debates the framers considered that the "liberty" to be protected is the common-law freedom from physical restraint or incarceration. In both the context of the time and occasion of its framing, and its connection with "due process of law," the liberty protection carried an equalitarian emphasis to a traditional procedural concept. It was part of the whole effort to "constitutionalize" the privileges, rights, and liberties of the newly freed colored persons in the southern states.

But since 1868 the Supreme Court has developed the concept of liberty in the Amendment along three lines in checking state action: (1) an increased attention to the traditional procedural liberty; (2) an emphasis for nearly a half-century on the liberty of the individual or corporation to enter into and operate business; and (3) a prolific development of civil liberty protection.

Though the Supreme Court judges, from the beginning of their interpretation of the Fourteenth Amendment, have considered procedural liberty part of an individual's liberty protected from state abridgment, prior to the mid-1930's they were reluctant to substitute their judgment of the necessary ingredients of a fair trial for the judgment of state judges. Important to the evolution of liberty has been the fact that the judges have since then felt a much greater compulsion to analyze individuals' complaints against state trial procedures with the result of upholding, in a high percentage of the cases, the appellants' pleas against the states. In this development they could have equated state procedures to federal but have chosen instead to apply such standards as "reasonableness," "fairness," or "natural justice."

The earliest appeal for a broadening of the meaning of liberty came from businessmen who claimed immunity from state economic regulation. By 1890 the Court, with a majority of "laissezfaire" judges, stepped in to prevent state legislatures from interfering not only with business property but also with the liberty to enter into and contract in the operation of business, unless the business was clearly "affected with the public interest." In the mid-1930's, again, a change in the attitude of the Supreme Court's justices appeared, when they discontinued speaking of the "liberty" to operate business, becoming on the whole very reluctant to impose any straight-jacket upon the states' regulation of their own economic affairs.

By far the greatest development, however, has come within the area of civil liberty protection. Commencing in 1925 the Court gradually wrote the First Amendment freedoms into the Fourteenth Amendment "liberty." The number of cases reviewed, with a broadening of the coverage, increased after 1937, with the result that the Supreme Court has become the major protector of an individual's liberty

to speak, write, worship, or assemble. A particularly important inclusion was the holding of the liberty to picket a part of the freedom of communication.

Thus the concept of liberty in the Fourteenth Amendment has grown. As a result of its development: (1) individuals now receive a greater protection of their liberty than if the state courts were the last resort; (2) state officials from the state-level legislator down through to the city policeman face the possibility of a judicial overlord negating their action; and (3) state judges have been forced to follow constitutional interpretation forged by the United States Supreme Court. 314 pages. \$3.93. Mic 56-581

THE PRESBYTERIAN CHURCH IN AMERICAN POLITICS: A STUDY IN CONTEMPORARY CHURCH-STATE RELATIONS

(Publication No. 15,270)

Gordon Lichty Shull, Ph.D.
University of Illinois, 1955

This study endeavors to describe the participation of one denomination (the Presbyterian Church, U. S. A.) in the public policy-making process. The primary focus is on the official activities of persons holding elective or appointive office in the Presbyterian Church, at all judicatorial levels, in the years 1952-1954. Attention is paid, at the national level, to the General Assembly, the Department of Social Education and Action, the major periodicals serving adults, and the General Council; and below the national level, to the Synod of Illinois, the twelve presbyteries within that Synod, and the local churches. Information on local churches was obtained through questionnaires sent to each minister who had served the same Illinois church in 1953 and 1954 (199, out of 260, were returned).

Agreement Among the Articulate

Year after year, the social pronouncements of the denomination's governing body espouse the same general cluster of political values, despite the fact that (a) most elections are routinized, and neither contested nor manipulated, and (b) fifty per cent of the governing body of each judicatory, above the local-church level, is composed of laymen. This cluster is characterized by support for the United Nations, foreign economic aid, international goodwill, racial desegregation, government intervention on behalf of groups deemed to be economically underprivileged, close adherence to the principles of free speech and association, and achievable legal victories over commerce in gambling and alcoholic beverages. These same political values are supported, with striking unanimity, by all of the denomination's periodicals, the Synod and presbyteries of Illinois, and (very likely) the great majority of ministers who discuss the issues in pulpit or church bulletin. Officials and judicatories below the national level tend to pay more attention to alcohol and gambling, and proportionately less to civil liberties, race relations, and international relations, than do their national counterparts.

Peripherality of Public Policy-Oriented Activity

Although the Department of Social Education and Action undertakes some direct lobbying, its major efforts are directed toward group study and action in the local church, vis-a-vis social questions. Synod, presbytery, and local-church committees of social education and action are supposed to facilitate this activity.

Relatively little activity of this nature occurs. In any given year, in the period 1952-1954, one-third to one-half of the presbytery social education and action committees in Illinois were either inactive or nonexistent. In no presbytery was there sustained contact, over a period of years, between the presbytery officer and local counterpart officers. As far as the responding ministers knew (and apart from women's organizations), there was no organizational-study of nationally-sponsored social education and action study-materials in seventy-five per cent of the respondent group in 1953-1954; no study of the General Assembly pronouncements in seventy-five per cent; no study of the "Letter to Presbyterians" in eighty-five per cent; and no study of pronouncements or "Letter" or study-materials in sixty per cent. Three ministers, out of 182 answering all relevant questions, reported organizational study of pronouncements and "Letter" and study-materials. Less than ten per cent of the ministers responding to the questionnaire had active, officially-designated committees of social education and action (separate questionnaires were sent to persons reported, by their ministers, to be chairmen of such committees).

230 pages. \$2.88. Mic 56-582

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

THE POLICY OF THE UNITED STATES WITH RESPECT TO POLITICAL QUESTIONS IN THE GENERAL ASSEMBLY OF THE UNITED NATIONS

(Publication No. 15,257)

Robert Edwon Riggs, Ph.D.
University of Illinois, 1955

The attempt to shed light on the functioning of international organization through a study of the policies and activities of a particular state or group of states is not new. In this case the political processes of the General Assembly are examined in relation to the extent and the means of influence exerted by the most powerful member of the organization. By "policy of the United States" is thus meant both the positions taken by the United States with respect to particular questions and the activities of the United States to promote acceptance of those positions. A "political" question, as herein defined, is one which in the Assembly legislative process is sent to the Political and Security Committee of the Assembly, or to the Ad Hoc Political Committee, for detailed discussion and recommendation.

On the basis of positions supported and fought through to final adoption, positions compromised, and positions abandoned or lost, the United States record for the first nine

sessions is on the whole an impressive one. With few exceptions the major aspects of American positions on political questions have been embodied in Assembly resolutions whenever the United States has exerted strong leadership. This degree of success has been accompanied, however, by continual concession on the detail of proposals. American leadership has been most apparent and most effective with questions of international peace and security and least in evidence with respect to questions arising as legacies of colonialism. In frequency of concurrence with an Assembly majority on eighty-six selected roll-call votes the United States ranks well ahead of the other Great Powers but below nine other members.

The methods by which the United States and other members seek to influence decisions of the Assembly illustrate the primacy of politics over legal forms. Through their permanent missions to the United Nations and their Assembly delegations, members participate in the Assembly legislative process at two levels — one formal and legal, the other informal, extra-legal, political. Frequently the formal Assembly machinery serves only to ratify decisions made through less well-regulated but highly effective channels outside the council chambers. The heart and sinews of this extra-legal structure are the innumerable meetings or caucuses at which groups of members attempt to forge a common approach to problems before the Assembly. The consultative relationships of regional blocs are an important part of this structure, but even more significant for Assembly functioning are the meetings, entirely ad hoc as to time and composition, of groups of members interested in a particular problem at a particular time.

The factors underlying American influence in the Assembly stem from national power, the economic dependence of other states, and the recognized need for leadership against communist imperialism. Voting majorities must be organized, however, through consultations and, not infrequently, through pressure. Pressure in this context means insistence, persistence, and emphasis rather than direct threats and bribes. Others, too, use pressure tactics, though not with the same degree of success. The partitioning of Palestine in 1947 and the condemnation of Chinese communist intervention in Korea afford striking illustrations of the interplay of pressure and counter pressure in the Assembly.

As other states increase in economic independence and as the threat of communist imperialism declines, the influence of the United States in the Assembly may be expected to decline. No eclipse of American leadership is to be anticipated, but the United States may have to learn to lose more often and more gracefully; and leadership may come to be measured less in terms of voting records than in the respect and good will of nations.

296 pages. \$3.70. Mic 56-583

ANGLO-RUSSIAN RELATIONS IN
CENTRAL ASIA, 1885-1892

(Publication No. 15,643)

Lois Stone, Ph.D.
Columbia University, 1955

During the years between 1885 and 1892 a great many negotiations were undertaken between England and Russia which concerned their relations in Central Asia, and a great many disputes were settled, some of them permanently. Some of these disputes were new; some of them, very old. Most of the officials concerned in these negotiations held the same posts during this period, and this undoubtedly contributed to the success of the negotiations.

The main settlement concerned the Afghan boundary with Russia. The boundary then negotiated is the one which exists today. Also, during this period, Abdur Rahman, the Amir, succeeded in establishing the modern Afghan state; and relations between Afghanistan, the Government of India, and Great Britain were stabilized.

Negotiations concerning Persia related, for the most part, to attempts to modernize that ancient Kingdom. Because of the reluctance of the Shah to consent to any change, for fear that they might undermine his shaky throne, and because of the conflict between England and Russia, very little came of these negotiations. Both European powers managed to strengthen their positions in the parts of Persia which bordered on their own territory. The partition of Persia into spheres of influence was well on its way.

One interesting aspect of this work is the light it sheds on relations between European and "underdeveloped" nations in the nineteenth century. The character and strength of the individual Eastern state had a great influence on how it fared in its relations with Western nations, and policies which were successful in Afghanistan could not be carried through in Persia, because of the differences between their rulers and the states themselves.

Another aspect is the contrast between the way the Russian and British Governments conducted their affairs. It is, of course, impossible to draw universal conclusions from a limited study, but differences in the organization of the two governments did have a great influence on the conduct of their affairs.

This study is also valuable for the light it sheds on the Anglo-Russian agreements of 1907. The provisions of this agreement which relate to Persia and Afghanistan were a ratification of the status quo of 1892.

358 pages. \$4.48. Mic 56-584

POLITICAL SCIENCE,
PUBLIC ADMINISTRATION

THE PUBLIC ADVISORY BOARD IN THE FEDERAL
GOVERNMENT: AN ADMINISTRATIVE ANALYSIS
OF SEVERAL BOARDS WITH PARTICULAR
ATTENTION TO THE PUBLIC ADVISORY
BOARD OF THE ECONOMIC COOPERATION
ADMINISTRATION AND THE MUTUAL
SECURITY PROGRAM

(Publication No. 12,697)

David Springer Brown, Ph.D.
Syracuse University, 1955

The use of advisory committees has increased phenomenally in the Federal government during the past two decades. In 1939, there were 82 such committees, but at the height of World War II the number was in the thousands. While it fell sharply with the end of hostilities, there are still several hundred active today. The number is again growing.

The interest of this dissertation is in one type of advisory committee, the public advisory board, as distinguished from the more numerous industry committees and the ad hoc commissions. The major characteristics of this kind of board are its concern for matters of broad agency policy, and a predominantly public membership which has little, if any, immediate financial interest in the matters on which it advises. Twelve representative public advisory boards were selected for special study, and one of these, the Public Advisory Board (PAB) of the Economic Cooperation Administration (later the Mutual Security Program), is examined in detail.

The major emphasis of this study is upon the four-and-a-half-year history of the PAB. It was established by statute as part of the European Recovery Program in 1948, its twelve members being appointed by the President and confirmed by the Senate. The dissertation attempts to illuminate the varying relationship of the Board to the three administrators of the agency who chaired it. Particular attention is given to the management of the Board and its organization and staffing, including an analysis of costs. Several of the programs in which it took particular interest are examined, and its influence assessed.

Its history falls broadly into three phases. The first phase, during the first year of Paul Hoffman's chairmanship, was marked by a major show of enthusiasm for the program and a desire to be helpful. Hoffman, however, had reservations concerning public boards, and the PAB got little encouragement. The second phase, from mid-1949 to January, 1954, was a period of ineffectualness and frustration. Attendance lagged as the Board did little save listen to agency reports. It was rescued from its doldrums by Averell Harriman, the new Director for Mutual Security. The third phase, covering the last thirteen months of the Truman Administration, was a period of re-awakened, participation, and support for the program.

The third phase produced the Board's most important contribution to the program, its study of U. S. trade policy, done at Mr. Truman's request. This project was undertaken with the dual purpose of providing an answer to a pressing public problem, and at the same time re-activating the Board. It produced the first full-scale study by a public agency of the relationship of tariffs and other trade barriers

to foreign policy. This project is described in case fashion with particular attention to the problems which faced the Board and the staff.

Although the PAB was created to give advice, it performed a variety of other functions. At times it helped in a public relations way; at other times it gave actual support to the program. It was a "listening post" reflecting public opinion, and also a facilitating device. But despite these activities and the desire of the members to be helpful, the Board was never a very important part of the program. Except for the year under Harriman, its potentialities were never fully realized.

While boards such as the PAB have grown in popularity in recent years, many agencies fail, as ECA failed, to take real advantage of them. There is no question that they pose difficulties and sometimes dangers. But over a period of time, this dissertation argues, the prudent administrator may find that their values outweigh their costs.

520 pages. \$6.50. Mic 56-585

THE VERMONT JUDICIARY: A STUDY IN CULTURAL ADAPTATION

(Publication No. 13,734)

Harris E. Thurber, Ph.D.
Princeton University, 1955

In many respects the judicial institutions of Vermont differ from those usually found on the state level of government. For example, judges are selected by three different methods, depending on the type of court involved; that is, they are either elected by the legislature, appointed by the governor, or popularly elected. Further, terms of office are short, being two years in the case of all judges. Beyond this, the judicial system has many archaic features. In many judicial systems these elements might tend to produce utter confusion.

The Vermont judicial system, however, in spite of these, and other characteristics, works well and answers the needs of the Vermont community. The principal reason why it works well is that it is adapted to, and integrated in, the culture and social environment of the community. This adaptation and integration occurs primarily in terms of its organization, its personnel, and its doctrine and serves as

a case study and demonstration of the maxim that institutions serve the needs of a community more or less well as they are more or less well-integrated in the culture of that community.

One important factor contributing to this adaptation and integration has been the complex of custom and usage which has grown up around and within the judiciary which has had the effect of modifying the constitutional and statutory provisions for the judiciary so that it is made more responsive to the needs of the community. In general, an even balance has been struck between legal and customary arrangements in the organization, personnel, and doctrine of the judiciary in its adjustment to community conditions.

A further factor making for integration and adaptation is the nature of the Vermont community itself. It has been characterized by a considerable measure of constitutional, political, economic, and social stability. It is not, however, stagnant as many suppose. It is only that it has not been subject to sudden and sharp changes in its way of life. Its politics has traditionally, since the Civil War, been one-party; its economy is one of agriculture and small business and manufacturing; its social structure is not characterized by great extremes either of wealth or poverty; its cultural atmosphere is distinctly rural and small-town in nature.

Within this setting its judiciary has been able to develop and adjust itself to the expectations of the community without being made subject to the pressures by which judiciaries in many other areas have found themselves assailed, pressures which often result from rapidly changing conditions or from highly urbanized and industrialized social environments. It has never been the subject of major scandal; charges of corruption have been conspicuous by their absence; its dockets are not over-burdened with cases nor are its judges over-burdened with work. Its structure has been kept relatively uncomplicated because a variety of specialized courts are not necessary.

The purpose of this study, then, has been to examine the arrangements provided by constitution and statutes for the judiciary and then to analyze the manner in which custom and usage have effected modifications in these arrangements. Then, following this, the purpose has been to analyze the complex of legal arrangements and customary usages thus evolved in terms of the structure, personnel, and doctrine of the judiciary in order to demonstrate that this complex fits the conditions and needs of the Vermont community.

413 pages. \$5.17. Mic 56-586

PSYCHOLOGY, GENERAL

THE VALUE OF A COMPARATIVE
ANALYSIS OF AN AUTHOR'S AUTOBIOGRAPHICAL
AND FICTIONAL WRITINGS FOR INTERPRETATION
OF ASPECTS OF HIS PERSONALITY: A STUDY BASED
ON SELECTED WORKS OF WILLIAM DEAN HOWELLS

(Publication No. 15,558)

Lois Balcom, Ph.D.
New York University, 1955

Chairman: Dr. Edward L. Kemp

The Problem

The purpose of this research was to develop techniques of document analysis which could be applied to both the factual and fictional writings of a single author, on the assumption that where individual psychological structure exerted paramount influence over objective situational elements, marked consistency would be manifested in the two modes of literary expression.

The Background: Theory and Method

The study rests upon current concepts of personality theory in which the phenomenon of "projection" or "autism" is seen as influencing the perceptions by which the "real" world is apprehended, as well as those acts and choices by which the unique character of that apperceptive experience is expressed.

Major elements in the technique were drawn from prior document analysis research, as follows: frequency of reference as a measure of importance of elements within the personality pattern (A. L. Baldwin's "Personal Structure Analysis"); the "rating" of personality attributes of fictional characters (H. G. McCurdy); quantitative description of autobiographical references to personal values (R. K. White's "Value-Analysis").

The Analytical Procedures

Personality portrayal by the author-subject, as it pertained to his subjects, non-fiction and fiction respectively, was the element of literary content upon which comparisons were focussed. Several thousand individual "trait-judgments" were tabulated, forming rank-orders or "frequency-patterns" of "trait-elements" for twelve non-fiction and nineteen fiction subject-ratings. Product-moment correlations were then run for seventy-three subject-pairs, producing a relatively objective measure of resemblance between each two personality patterns compared. Correlations between the author's ratings and those for other subjects were considered to lead to, though not in themselves constituting, a measure of the degree to which he projected his own attributes into the fictional versus the "real-life" subject portrayals.

Selection of Subject and Materials

William Dean Howells was chosen as author-subject because of (1) availability of published materials in the desired categories, (2) apparent absence of "deviant" characteristics in his own personality, and (3) his former influence and present neglect in American letters.

The "factual" materials were selected from autobiography, biography, and memoirs; the fictional consisted of one major novel, *A Hazard of New Fortunes*, and a minor "chronicle," *New Leaf Mills*, included because of its special biographical/fictional character.

The Findings

Although author-subject resemblance was common to both factual and fictional categories, fulfilling the terms of the initial hypothesis, the most striking outcome as a distinctly higher degree of resemblance between Howells and his real-life subjects, despite the limitations upon his personal "projections" imposed by the factual character of such portrayals, than between the author and his fictional characters, not even excepting the "reference" subject, Basil March, long considered his creator's autobiographical representative in fictional guise.

Discussion

Since it was not assumed that high correlation in itself denoted the presence of the author's projections, the actual evidence for or against this phenomenon was appraised in the light of known author-subject relationships in each case. The general inference drawn from the correlation table, that projection did indeed predominate in the non-fiction area, was amply supported by the discussion of individual subject-pairs.

Conclusions

The conclusion is reached that William Dean Howells' "projective pattern" involved a high degree of projection or identification in his way of life, coupled with a considerable objectivity, or relative absence of projection, in his creative work; in other words, that he lived projectively, but he wrote objectively. This aspect of his personality is seen as bearing an important relation to that realism which was so important an element in his literary creed, as well as to his autobiographical method. 479 pages. \$5.99. Mic 56-587

A PSYCHOMOTOR, PSYCHOMETRIC,
AND PROJECTIVE STUDY OF MENTALLY
DEFECTIVE TWINS

(Publication No. 15,560)

George Stanley Baroff, Ph.D.
New York University, 1955

Forty pairs of identical and fraternal twins, institutionalized as mental defectives in New York State schools, were examined with a battery of psychomotor, psychometric, and projective tests in order to determine whether genetic factors significantly influence these functions.

No significant differences obtained between the intra-class correlations of the twin groups on measures of equilibrium, kinesthesia, and gross and fine hand-eye coordination. It is concluded, within the delimitations of the research, that hereditary factors do not play a significant role in individual differences in these functions among the high-grade mental retardate.

Monozygotic twins were significantly more similar in their intelligence — as measured by mental age. The genetic contribution to mental age has now been disclosed in the defective as well as normal ranges of intelligence.

A comparison of the degree of similarity in mental age of younger and older identical and fraternal twins revealed that within a relatively constant and equivalent environment, the length of institutionalization did not alter the degree of similarity of identical twins but fraternal twins tended to become increasingly dissimilar. These data support the theory that genetically unlike individuals tend to grow in-

creasingly different in their manifestation of an inherited trait within a similar environment.

The twins were compared on the Wechsler Intelligence Scale for Children to ascertain whether any of the mental abilities measured by this test have a genetic basis. No significant differences existed on the twelve verbal and performance tests. The inheritance of specific mental capacities as opposed to general intelligence (given by the IQ or mental age) has yet to be adequately demonstrated.

The twins were rated on eleven personality traits from projective data provided by the Rorschach and House-Tree-Person tests. A twin pair was "similar" with regard to the trait if they had the same rating and "dissimilar" if their ratings differed by one or more categories on the scale. No significant differences were found for any of the traits.

Peripheral to the specific problems of the research was the observation of significantly higher IQ in the fraternal twins. The basis for this superiority is unexplained except to note that a similar result was obtained from an extensive survey of non-institutionalized pre-school and school-age French twins.

In summary, although on almost all of the psychological measures higher intra-class correlations were found for the identical twins, only mental age emerged as a factor significantly influenced by heredity.

122 pages. \$1.53. Mic 56-588

ONE YEAR'S GROWTH OF ELEVEN TO FOURTEEN YEAR OLD BOYS AND GIRLS AS MEASURED ON THREE RELATED DEVELOPMENTAL TASKS

(Publication No. 15,486)

Helen Tate McMullen Bayer, Ph.D.
Cornell University, 1955

The Dales Problem Check List yields a scaled measurement of students' status in relation to sixteen (boys') or seventeen (girls') subtasks representing the late childhood and early adolescent levels of three developmental life tasks most frequently listed as concerns by boys and girls of eleven to fourteen years of age.

In an attempt to explore the operational meanings of a year's growth (change) as it is recorded by this instrument and to investigate how that change is related to the variables of sex, age and physiological maturation, the writer:

1. retested one hundred and sixty-one boys and girls of eleven to fourteen years two weeks after their initial testing by Dales in 1952 and compared their responses to assess reliability of response.
2. interviewed thirteen of those students retested in an attempt to obtain reasons they could proffer for change in so short a time.
3. retested four hundred and nine students one calendar year after their initial testing.
4. in cross-sectional analysis, compared the 1952 data and the 1953 data according to stability of response, stability of the thirty-three Guttman scales, and stability of the patterns of late childhood and early adolescent involvement.
5. in longitudinal analysis, considered the responses of the same students two successive years for evidence of statistically significant change in total late childhood and in total early adolescent scores; and compared the amount of change among sex-age-physio-

logical maturity groups.

6. compared the changes in the totals of late childhood and early adolescent subtasks with the changes in the individual subtasks therein.
7. related the proportional importance of late childhood and early adolescent subtask concerns in increasing age groups.

The findings of the study indicate that:

Unreliability of response may be confused with growth, in an instrument such as this. The instrument itself appears to encourage some students to look for solutions for their problems; thus, the assurance that they will find help as they need it is a part of the responsible administration of the check list.

The stability of response differs according to subtask content. Concerns related to parental authority seem somewhat more stable than those related to personal autonomy.

The thirty-three Guttman scales remain, in general, measures of unidimensional attitudes.

Late childhood subtasks follow the anticipated pattern of decreased involvement with increasing age in both the 1952 and the 1953 data; early adolescent subtasks do not. However, the ratio of late childhood statements to early adolescent statements mentioned as concerns does yield patterns of simultaneously decreased involvement in late childhood concerns and increased involvement in early adolescent concerns with increasing age.

The instrument does measure significant changes in students' responses over the period of one calendar year. These changes vary significantly among sex and age groups; and there is significant variation also among maturity groups for girls.

277 pages. \$3.46. Mic 56-589

AN OPERATIONAL APPROACH TO THE EVALUATION OF OFFICE JOBS

(Publication No. 14,444)

Edmund Emil Dudek, Ph.D.
Purdue University, 1948

Major Professor: C. H. Lawshe

The hypothesis was proposed that a simple, understandable, and easily used plan for the evaluation of office jobs could be based on the tasks or operations performed on each job.

First, a list of tasks performed on office jobs was prepared and the descriptions of these tasks were checked for clarity and completeness of coverage. Next, the tasks were evaluated by nineteen raters using the Method of Successive Intervals. Finally, the resulting check-list of 139 task-items was used in the evaluation of a sample of 150 office positions. These positions were evaluated in terms of the scale values of the task-items weighted for approximate amount of time used to perform each task on each position.

The check-list plan took little time in application and was easy to use for job evaluation. It is suggested that the check-list may also prove valuable for job description and position classification purposes. Position evaluations, as arrived at by this plan, correlated .84 with a proposed job evaluation point system on a sample of 130 positions from one plant. Further experimental trials with the check-list plan to determine its acceptability to management and workers is recommended. 104 pages. \$1.30. Mic 56-590

A READING COMPREHENSION TEST FOR INDUSTRIAL SUPERVISORS

(Publication No. 14,393)

Roy Dressler Dunlap, Ph.D.
Purdue University, 1955

Major Professor: Joseph Tiffin

A research problem in the development of a reading comprehension test for industrial supervisors, covering an approximate educational range from the fourth grade through college graduate, for the purpose of categorizing supervisors as "good," "average," or "poor" readers compared to supervisors in general.

The aim of this research project was to develop a reading comprehension test for industrial supervisors which would have face validity, would discriminate among good, average, and poor readers over a wide range of educational levels, and would not take more than thirty minutes to administer.

A preliminary form was developed and checked against expert opinion and tested upon a group of college undergraduates. From the results of this study an experimental form was developed and tried out upon over six hundred industrial supervisors from all levels of management. Item analysis, reliability, and validity studies were made using the data obtained, and as a result of these studies a final test form of forty-five items was developed which could be administered in a reasonable length of time and which showed satisfactory reliability and validity for the purpose for which it was designed.

It is believed that the test will be useful in helping industrial managements solve some of their communication problems by indicating just how well various levels of their supervisors can read compared with supervisors in general. There is also the possibility eventually of relating the norms established for supervisors in general to some kind of simple reading ease formula, in order to provide a practical guide to intelligible communication in industry.

75 pages. \$1.00. Mic 56-591

A CONFLICT INTERPRETATION OF CERTAIN PERCEPTUAL DYNAMICS

(Publication No. 15,244)

Archer Lester Michael, Ph.D.
University of Illinois, 1955

This experiment was designed as an attempt to verify a conflict interpretation of the perceptual dynamics of relative lowering and raising of the visual selection threshold. It was hypothesized that the experience of reward associated with a visually presented symbol would create a gradient of approach for that symbol, which would manifest itself perceptually as a tendency to select that symbol as "outstanding" when it was viewed with other symbols. The height of the approach gradient was hypothesized to be a function of the level of awareness, which was controlled by varying the exposure time of the symbol. It was further hypothesized that the experience of both reward and punishment to a symbol would create both approach and avoidance gradients for that symbol, and these would manifest themselves perceptually

as a tendency to select the symbol as "outstanding" more frequently at low levels of awareness and less frequently at high levels of awareness. This latter condition was hypothesized to be a conflict situation, and it was predicted that the latencies of verbal response would increase at the level of awareness where both tendencies were nearly equal.

The design employed was that of the familiar ABA design used in the study of the retroactive effects of interpolated tasks. Stimuli were the four symbols from playing cards which were selectively associated with monetary reward or monetary punishment. A Gerbrands tachistoscope was used to present the stimuli at speeds both below and above the recognition threshold.

The 92 subjects were student volunteers from an introductory psychology course and were divided into three groups: a Control Group (N = 20), a Reward Group (N = 36), and a Reward-Punishment Group (N = 36).

The results of the experiment failed to support the two main hypotheses in that neither of the dependent variables, frequency of selection and latency of verbal response, followed a gradient form. However, the data permitted the deduction of certain secondary hypotheses which permit the general statement that the experience of reward led to a significantly greater frequency of selection at an interval below and an interval above threshold, while the experience of both reward and punishment led to a greater selection at an interval below threshold but not above. Also, the Reward-Punishment Group was the only group that failed to improve in verbal latencies near the threshold.

Some of the possible reasons for the failure of the design to produce more definite conclusions were examined, and certain advantages of a single, as opposed to a dual, explanatory model for certain perceptual dynamics were discussed. In the light of these advantages and the fact that our conceptual model is an extension of an already well systematized theoretical approach, it was concluded that some unidentified inadequacy of the experimental design, rather than of the conceptual formulation, was responsible for the inconclusive result.

112 pages. \$1.40. Mic 56-592

SELECTIVE PROCESSES IN A JUNIOR HIGH SCHOOL: SOCIOMETRIC CHOICE PROCESS AND PERSONALITY ACCOMPANIMENTS

(Publication No. 15,575)

Karl H. Platzter, Ph.D.
New York University, 1955

Our civilization is one of increasingly complex social, economic, and political structures. Assurance of continued competent leadership is essential to maintenance and advancement of our well-being. In a democratic interrelationship, leaders are freely chosen by the choice of the led. Who are these leaders? Whence do they arise? What factors determine their choice? Are they a breed apart, or are they part of, and conditioned by, their social milieu?

Specifically, in this study it was sought to determine whether office-holders in the group showed constellations of traits that could be distinguished from those possessed by non-office-holders. Do office-holders have personality

factors so significantly their own that those who vote them into office can recognize and identify with them? Particularly among adolescents, at this time, these questions are important.

The group studied consisted of all the pupils attending Passaic, N. J., Junior High School. They numbered 409, of whom 117 were leaders, persons who had been elected by their fellows to positions of responsibility. The remaining 282 held no elective positions.

Varied well-validated instruments were used to collect data concerning personality, social, and physical traits of each individual. In all, 25 factors were tested. Of these, 6 variables proved significant on a level of one per cent or better, in discriminating between leaders and non-leaders. These 6 variables were combined in Fisher's technique of Discriminant Function to determine their multiple correlation with the criterion of leadership or non-leadership. The multiple R of .416 found was significant at much better than a one per cent level of confidence. In the possession of the traits found significant, leaders were definitely discriminated from non-leaders and from their entire group.

The constellation of traits significantly possessed by the office-holder was composed of: intelligence, sense of personal worth, feeling of belonging to his group, over-all personal adjustment, social acceptance, satisfactory relationships with his society, and high choice status. In addition, leaders showed self-reliance, and freedom from withdrawing tendencies, at better than a five per cent level of confidence.

The factors of sociometric choice correlated most highly with leadership. Point biserial r 's of .25 and .33 were found for formal and informal choice status, respectively. These correlations are so significant as to suggest strongly that the choice procedure may share much of a common basis with the elective process.

The leaders in this study were found to differ significantly from non-leaders and from their entire group, in the possession of certain traits. These traits are, in the main, social factors. They arise from the group setting. It is probable that children can be trained into possession of those socio-personal adjustments which in their society would make for leadership. Individual personality traits may well be determined objectively, and conducted through manipulation of the individual's social milieu and his inter-relationships therein. Implications of such conclusions would seem relevant to many fields. The areas of mental hygiene, industrial and military psychology, psychotherapy, and education in general, form such spheres.

The instruments and methods used in this study have demonstrated their value. They may well be extended to further use in the areas mentioned above.

65 pages. \$1.00. Mic 56-593

A FACTOR ANALYSIS OF ANXIETY VARIABLES

(Publication No. 15,258)

Irene Rosenthal, Ph.D.
University of Illinois, 1955

An investigation of a number of measures of "anxiety" used in current research was undertaken to determine

whether one concept is referred to in the studies, or if it is not a unitary concept, the relations between the various tests. For the experiment, fifty-four variables were selected from questionnaire, objective, and physiological tests, the choice being based on the promise shown by these tests in previous research. The tests were administered to seventy students at the University of Illinois. From the results, the product moment correlations between all the variables were obtained. A centroid factor analysis was then performed, and rotations were carried out until simple structure was reached.

Eleven factors were extracted in the centroid analysis, of which the following nine turned out to be interpretable:

1. The first factor was clearly one of "anxiety" and brought together the Taylor Anxiety Scale, UI 24 (the anxiety Scale from Cattell's objective test battery) Q_4 and O (the factors from Cattell's 16 PF questionnaire which measure anxiety), and to a lesser extent Factor C (the neuroticism factor of the 16 PF test). A number of other variables found on Factor 1 fit in with the meaning of the factor.

2. Factor 2 was found to match Cattell's objective test factor, UI 20 (social willingness) but variables measuring recovery in PGR after stress also appeared. The association mentioned above suggests that one facet of the "good adjustment" which correlated with good recovery quotient in a study of Freeman and Katzoff is prominent in this factor, that involving social responsiveness and adequacy.

3. Factor 3 was matched with Cattell's objective test factor UI 17 (restraint-inhibition) but a number of discrepancies make this match a rather poor one. Conditioning and extinction load this factor, and although the association may be a spurious one, there is some experimental evidence indicating this to be a genuine relation.

4. Factor 4 was matched with Cattell's objective test factor UI 22, and R-technique factor measuring high, nervous speed, and the corresponding P-technique factor, PUI 2.

5. Factor 6 was tentatively matched with Eysenck's dysthymia-hysteria factor, since these two factors had several common variables, and another variable fitted in with the meaning of the factor.

6. Factor 7 was checked against Wenger's autonomic factor, since the variables loading this factor in the present study were also employed in that study, but no match was found. This indicates the need for more investigation of autonomic function and its relation to psychological variables.

7. Factor 8 was matched with the R-technique UI 19 (critical exactness) and the corresponding P-technique factor (PUI 5) both found in studies of Cattell. The match was marred by a number of discrepancies.

8. Factor 9 had as its best match Cattell's UI 18 (hypomanic anxiety) but the match is a very poor one. Some PGR variables appearing here fit in with the meaning of the factor.

9. Factor 10 corresponds best to Cattell's UI 25 (accurate realism vs. "psychotic tendency") but the match is again somewhat unsatisfactory, partially as a result of the absence of common variables in the two studies.

Implications for research in the area of "anxiety" can be drawn from this study. The demonstration that "anxiety" is not a unitary concept points to the need for careful consideration by investigators of the type of "anxiety"

they wish to measure in their research. Factor 1, the major anxiety factor of the study, will provide a clearer definition of the type of anxiety especially prominent in questionnaire tests representing free-floating anxiety and psychosomatic symptoms, after more refinements are made on some of the tests loading this factor to provide a better measure of the factor.

103 pages. \$1.29. Mic 56-594

THE INFLUENCE OF CONTEXT ON THE PERCEPTION OF COMPLEX STIMULI

(Publication No. 15,260)

Stanley Arthur Rudin, Ph.D.
University of Illinois, 1955

Most of the work on perception has used geometrical forms and other non-human objects as stimuli. Recent developments in social perception suggest the importance of ascertaining the extent to which principles derived from physical perception are properly relevant to perception of figures representing persons. The present research was designed to explore this problem. Directly tested was one aspect of the hypothesis that these two classes of stimuli are perceived in accordance with the same general principles. Subsidiary hypotheses were tested regarding certain stimulus variables in the pictures of persons, and regarding relations of perception to the "authoritarian" personality.

The dimension of perception chosen was the ability to perceive the figure relatively independently of the influence of the ground. This is substantially the dimension that has been called "field-dependence vs. field-independence" and "levelling vs. sharpening" by previous investigators. The three classes of tests were as follows. (1) Physical object perception: the Thurstone version of the Gottschaldt embedded figures test, the Witkin version of the rod-and-frame test, and the brightness contrast test. The first two measure ability to perceive forms independently of surrounding forms and contours, and the last, ability to perceive shades of gray independently of background. (2) Social perception. In the Self Contextual Influence (SCI) test, S was asked to imagine himself in four different situations, and to describe himself as he was in each of these situations on a set of 15 rating scales. By appropriate statistical methods, a score was obtained showing how much the ratings varied over situations. In the second, the Picture Contextual Influence (PCI) test, the S was presented with 32 pictures made up of figures of eight different persons, each of which was placed against each of four different backgrounds. S told a story about each picture (as in the TAT) and rated each figure on the same set of 15 rating scales. A score was derived for each subject that showed how much his ratings of the figures of persons tended to change from background to background. In the SCI, the figure is the self and the ground is the imagined situation; in the PCI, the figure is the picture of a person and the ground is the background. (3) The F-scale was administered as a test of authoritarian attitude.

The major hypotheses were confirmed. Two of the three tests of object perception (embedded figures and rod-frame) correlated significantly with each other. The SCI and PCI tests correlated significantly and positively with the embedded figures and rod-frame tests, and with each other.

It was also found that people who are influenced by ground in perceiving the figure tend to score toward the "authoritarian" end of the F-scale.

The exploratory data showed that some figures are influenced more by some backgrounds, and that different figures produce markedly different responses. These were not, however, in line with the stimulus dimensions originally proposed.

The major results are related to one another by the concept of "ego strength", which is reconsidered and defined in such a way as to relate it to concrete operations. Speculations are offered as to the concept of the ego in terms of a neurological theory of behavior.

150 pages. \$1.88. Mic 56-595

PSYCHOLOGY, CLINICAL

A STUDY OF CERTAIN PERSONALITY CHARACTERISTICS OF NON-READERS AND ACHIEVING READERS

(Publication No. 12,399)

Jules C. Abrams, Ph.D.
Temple University, 1955

Problem:

The particular purpose of this study was to discover whether significant differences existed in the personality characteristics of non-readers and achieving readers as measured by the Wechsler Intelligence Scale for Children, the Brown Personality Inventory, the Social Adjustment Inventory, and the Rorschach technique.

This study differed from previous investigations of the relationship between personality adjustment and reading disability primarily with respect to the criteria utilized for the selection of non-readers. A review of the literature revealed that earlier studies had been concerned with subjects with varying degrees of reading retardation rather than with the kind of non-reader described in this study.

Subjects Used:

Twenty-five male non-readers between the ages of 8-0 and 12-0 of normal or above normal intelligence were matched individually with twenty-five male achieving readers on the basis of chronological age, intelligence quotient, and number of years in school. Only those individuals were considered whose educational background appeared to be sufficiently adequate to provide opportunity for acquiring such a skill as reading. The population used in this study was taken from cases referred to the Temple University Reading Clinic and from various elementary schools in the Philadelphia metropolitan area. All of the tests were administered, scored, and analyzed by the author.

Procedure:

In order to test for the significance of differences between the non-reader group and the achieving reader group on the WISC variables and the five areas of the Brown inventory, the Student t-test was employed. Chi square was used to

test for significance of differences between the sample groups with respect to Rorschach factors and the three categories on the Social Adjustment Inventory.

Results and Conclusions:

The findings on the WISC revealed that the non-readers of this study achieved significantly lower scores on the Verbal section than did the reading achievers. An examination of the primary functions measured by the Arithmetic and Information sections — the two sub-tests which made the major contribution to the difference in verbal intelligence — indicates that some selective retardation of intellectual capacities had occurred in the non-reader group. The latter's significantly lower achievement on these sub-tests tends to verify the hypothesis that anxiety on the part of the non-readers influences negatively their ability to function efficiently in learning situations that stress attention, concentration, and recall. The interfering effect of anxiety was also reflected by the non-readers' poorer achievement on the Vocabulary sub-test, although this may be accounted for merely in terms of a reduced opportunity for concept development. It is important to note also that the interference in attention and concentration which is so markedly characteristic of the non-reader group apparently was confined to items of an abstract nature. A significant difference between the achieving readers and the non-readers was not found on the Picture Completion sub-test which, although measuring concentration, utilizes relatively concrete stimuli.

In response to a personality inventory non-readers evaluated their adjustment to their present environment as significantly less satisfactory than achieving readers. The former group rated itself as more insecure, more unstable, and as experiencing more difficulties in home and school adjustment than the reading achievers.

The parents of the non-readers did not report deviations in general health habits, nervous habits, or kinds of personal characteristics differing significantly from the traits reported by the parents of the reading achievers. This is not in accordance with the non-reader's own evaluation of his adjustment and may be accounted for in part by the limitations of a parent's appraisal of a child's personality in an educational clinic situation.

Among the Rorschach variables the most significant finding was the greater use of the determinant FC by the reading achiever. On the other hand, the non-readers made as much use of the CF and C determinants as the achieving readers. This would indicate that the achieving readers in this study evidenced greater capacity for emotional adaptation, while the non-readers' responses were more representative of emotional irritability, impulsiveness, and inadequate control. This hypothesis is verified by two other Rorschach variables: (1) the greater total time taken by the achieving reader showing capacity for delay and caution, and (2) the significantly larger number of good adjustment ratios ($FC < CF + C$) evidenced by the achievers. This again would indicate that the reading achievers in this study demonstrated greater ability for adaptive emotional expression and affective control.

Another finding of interest was the non-readers' significantly greater use of the determinant K which is assumed to be representative of feelings of anxiety. This, of course, is another substantiation of the findings on the WISC and Brown Inventory. This is further verified by the indication that the non-readers of this study were more inhibited and constricted ($F\%$) than the achieving readers. The latter

group also evidenced better inner control and higher integrative achievement (M) with greater ability for expression of their instinctual drives than did the non-readers (FM). Superior control was further indicated by the achieving readers with their greater use of D which indicates more efficient application of attention to a given problem.

In conclusion the findings of the major portion of this study indicate that there are personality characteristics which differentiate the non-reader from the achieving reader. Non-readers experience difficulty in maintaining sustained abstract attention probably as a result of feelings of anxiety. They are acutely aware of their difficulties which are reflected in symptoms of insecurity, irritability, and poor home and school adjustment. They are decidedly more impulsive and less able to respond appropriately to emotional stimuli. These personality traits bear particular relevance to the non-readers' incapacity for adequate means of expression and effective control of emotions under the stress of reading failure. 108 pages. \$1.35. Mic 56-596

THE EFFECTS OF ELECTROCONVULSIVE THERAPY ON EMOTIONAL REACTIVITY: AN ATTEMPT TO RELATE THE PSYCHOLOGICAL CHANGES THAT OCCUR IN ECT TO THE MECHANISM OF REPRESSION

(Publication No. 15,559)

Peter Paul Barbara, Ph.D.
New York University, 1955

Chairman: Professor Bernard Kalinkowitz

This is a study of the responses associated with emotional disturbances in two groups of shock treated patients, seventeen Improved as contrasted to fifteen Not-Improved ones. Responses associated with emotional disturbances were derived from the Orbison Word Association List, Garrison's Anxiety Inventory and the Thematic Apperception Test. The problem is to determine what differences exist in responses associated with emotional disturbances before and after treatment in the two groups. The differences between the groups are evaluated with regard to three attributes of responses, namely, quality of responses, intensity of anxiety and intensity of feelings. The basic hypothesis being examined is whether changes in emotional reactivity occur in association with ECT.

The subjects are thirty-two white, female patients between the ages of twenty and fifty years in the Fairfield State Hospital, Newtown, Connecticut. None of the subjects have been treated with ECT before the time of this study. None of the subjects are suffering from any complicating organic illnesses. The completion of the ECT course was determined by the treating psychiatrist's judgment of clinical changes in the patient. The Improved group are patients who showed more than fifty per cent post-ECT decrease in score on the Northport Record for Description of Psychiatric Patients, (NRDPP). The Not-Improved group are patients who showed less than fifty per cent decrease or any increase in their post-ECT scores on the NRDPP. All patients are from the acute, intensive treatment wards as distinguished from chronic treatment wards.

The groups are evaluated with respect to age, education, intelligence, number of treatments, time required for completion of treatments and duration of hospitalization. The mean ages are: Improved-38; Not Improved-34. The means for the highest school grade completed are: Improved-10.5; Not-Improved-10.3. The means for intelligence quotients are: Improved-103; Not-Improved-103. The means for the number of treatments are: Improved-17; Not-Improved-19. The means for the number of weeks required for the treatments are: Improved-7; Not-Improved-10. The means for the number of weeks of hospitalization are: Improved-12; Not-Improved-13. The differences among the means on each of these factors are statistically unreliable.

Quantitative and qualitative findings are derived from both pre and post-ECT test data. These findings are interpreted within the frame of reference in which the psychodynamic theories of repression are used as explanatory principles.

Interpretation and discussion of the findings indicate the following conclusions:

1. ECT can effect a reduction of association disturbances in some patients. The latter are those who appear to improve with treatment as judged by the NRDPP. The suggested explanation is that a reduction of association disturbances facilitates ego-integrating processes.
2. ECT can increase association disturbances in some patients. The latter are those who do not improve with treatment. The suggested explanation is that the treatments can weaken repression processes and thereby bring about greater ego-disintegration than they showed before treatment.
3. The treatments effect a reduction of anxiety in general but the reduction is more pronounced in those people who improve than those who do not. The treatments may have no effect or increase anxiety in subjects who do not improve.
4. Electroconvulsive treatments do bring about alterations and changes in feeling states. These alterations manifest themselves in reduction of emotional expressiveness.
5. In general, the extent to which subjects manifest behavior indicating excessive reliance upon repression mechanisms is partially the extent to which they will not benefit from treatment, particularly those subjects whose basic conflicts involve anxieties associated with inhibition of sexual feelings.
6. The treatments can bring about strengthening of repression processes, particularly in those subjects whose basic conflicts involve anxieties associated with inhibition of hostile feelings.

173 pages. \$2.16. Mic 56-597

THE RELATIONSHIP BETWEEN SELECTED INFORMATION MEASURES AND PERCEPTUAL-MOTOR ABILITY IN CARD SORTING TASKS

(Publication No. 15,111)

Gordon Maurice Becker, Ph.D.
University of Pittsburgh, 1955

The purpose of this study was to investigate the relationship between information measure and intelligence.

The relationship between response speed and task complexity was also studied. Three hypotheses were tested. The first hypothesis was that fast perceptual-motor subjects process information faster than slow perceptual-motor subjects. This hypothesis was rejected. The second hypothesis was that responses involving both motor and information processing components depend more upon the information processed than upon the number of alternatives or choices involved in the responses. This hypothesis was accepted. The third hypothesis was that information processing alone depends more upon the information processed than upon the number of choices or alternatives. This hypothesis was tentatively accepted.

Forty experimental subjects were selected from 83 undergraduate students in two elementary psychology classes. The subjects were selected according to sex and scores on three group-administered speed tests. The tests provided measures of motor speed and perceptual speed factors. The subjects were divided into four groups of ten subjects each, separately by sex, according to high and low scores on the perceptual-motor tests.

The experimental tasks consisted of sorting decks of 48 cards each according to numerals printed on the cards. Five decks of cards, varying in information from one to three bits per card, and varying in number of sorting categories from two to eight alternatives, were employed. The decks were sorted under two conditions. A deck was first sorted after the subject had memorized the exact sequence of cards in the deck. This was called the motor sort and provided a measure of the speed of utilizing stored information and converting to motor codes. The same deck of cards was immediately sorted again with the cards arranged in random sequences unknown to the sorter. This was called the information sort and provided a measure of combined information-processing and motor-encoding speed. The difference between the motor and information sorting times for each pair of deck sorts was also computed. These differences provided measures of information-processing speed.

Every subject sorted each of the five decks four times, twice for motor speed and twice for information speed. The times taken to sort the decks were recorded.

The difference between the processing scores of the high and low perceptual-motor speed groups was not significant. It was concluded that information process speed is not a function of perceptual-motor ability.

Significant differences between the high and low perceptual-motor groups were found on the motor speed and the information speed sorts. The motor speed scores were a function of the number of sorting categories, but were independent of the amount of stored information. The information speed sorts were a linear and monotonically increasing function of the amount of information processed, but were independent of the number of sorting categories. The information-processing rates were a function of both the information processed and the number of sorting categories. The relationship did not appear to be linear except under certain inter-action conditions.

The results were related to previous studies and new areas of research were proposed. The relationship between information processing and intelligence was discussed. Implications for learning were presented and discussed.

64 pages. \$1.00. Mic 56-598

THE VALIDITY OF COUNSELORS'
PREDICTIONS OF COLLEGE SUCCESS
FOR VETERANS ENROLLED IN A
SCHOOL OF BUSINESS ADMINISTRATION

(Publication No. 12,400)

Walter Hannaum Brackin, Jr., Ph.D.
Temple University, 1954

This study was planned to meet the need for further research in evaluating counseling, and to add to the literature on evaluations which use multiple criteria and multiple data. To this end, an investigation was made of the predictive value of counselors' recommendations for veterans whose occupational goals at the time of counseling, or eventually, involved training at a college school of business administration.

Specific data were collected for studying (1) to what extent the counselors were able to predict success or failure in college, and (2) the relationship between the counselors' recommendations and the level of academic achievement of those who graduated.

The data were collected from the test records and profiles, official summary forms, and write-ups of the cases held in the files of the Temple University Veterans Administration Guidance Center; and from the individual scholastic records in the office of the Registrar.

The criteria used for selection included the veteran's having been counseled at the Temple University Veterans Administration Guidance Center prior to enrollment, or while enrolled, as a student in Temple University's School of Business and Public Administration, majoring in accounting, business administration, or marketing; and being awarded a baccalaureate degree between February, 1949, and August, 1952, or being dropped for low scholarship between 1946 and 1952.

The 268 cases available after applying the criteria, were classified according to the original counselor's action in recommending or not recommending college training, and eventually being graduated or dropped for low scholarship.

The data were weighted, according to the counselor's use of them in supporting his recommendations for or against college training, on a five-to-one scale: 5-very favorable (for success in training); 4-favorable; 3-adequate; 2-unfavorable; 1-very unfavorable. The determinants for which factual data existed in the case folder were labeled Specific; estimations and evaluations based on observations made by the counselor during the counseling process were labeled Non-Specific Determinants. These were recorded for each case, by number and weight for Specific and Non-Specific determinants, favorable and unfavorable Specific and Non-Specific determinants, and the totals of numbers and weights.

Three judges reviewed the case folders and rated, on the five-to-one scale, in terms of probable success in training, the results of scholastic aptitude tests (the American Council on Education Psychological Examination and/or the Ohio State University Psychological Test), general mental ability tests (the California Test of Mental Maturity, Adult Form; the Wechsler-Bellevue Intelligence Scale, Adult; and/or the Otis Quick-Scoring Mental Ability Tests, Gamma); the results of the Kuder Preference Record and/or the Strong Vocational Interest Blank; and their total estimate of probable success in college training.

A third weighting, following the same procedure, was made by the author.

The data thus secured was coded for transfer to IBM cards. The cards were punched, listings made of the data, and counts made of the numbers and weights of determinants according to the classifications of the individual cases. Frequency tables were constructed for statistical analysis.

Pearson's chi-square technique was used to test the hypothesis that the frequency distribution of determinants according to weights and numbers was a chance one, using the outcome-of-training (graduated or dropped-for-low-scholarship) and the honor-point ratio (scholastic achievement) criteria. The limit set for χ^2 significance was at the 5% level. Where the N of the cases was less than fifty in frequency, the χ^2 technique was not considered to be practical. Those tables were, therefore, presented as frequency tables only.

With the outcome-of-training criterion, application of the χ^2 technique showed a predictive value significant beyond the 1% level for the counselors' over-all recommendations and for the specific determinants scholastic aptitude, measured interests, general mental ability, college scholastic record, clerical aptitude test results, reading proficiency, arithmetic achievement, and proficiency in English. The totals of specific determinants by numbers and weights, and by favorable numbers and weights, resulted also in χ^2 values significant beyond the 1% level. Within the limitations of this study, the specific determinants proved to be, individually and collectively, significant for predicting success or failure in a college training program.

The scholastic aptitude and the college scholastic determinants were individually significant for predicting scholastic achievement, using the honor-point ratio criterion. The remainder of the specific determinants by numbers and weights were significant in predicting scholastic achievement.

The total number of all determinants, specific and non-specific proved to be significant beyond the 1% level with the outcome-of-training criterion, but not significant with the honor-point ratio.

The one non-specific determinant which occurred with sufficient frequency for use with the χ^2 technique, the estimate of personality, was significant beyond the 1% level. The other nine non-specific determinants were motivation, quality of verbal expression, expressed interests, estimates of maturity, personality adjustment, study habits, self-understanding, attitude towards courses, and emotional stability. The total weights and numbers of the non-specific determinants were significant for predicting the outcome of college training, but not for predicting the honor-point ratio.

The counselors' over-all recommendations were not significant in predicting the honor-point ratio.

The author's evaluations of scholastic aptitude, general mental ability, and total estimate of probable success proved to be significant for the success-in-training criterion. With the honor-point ratio, evaluations of general mental ability and estimates of probable success proved to be significant. The scholastic aptitude evaluations were not significant with the honor-point ratio criterion; and measured interests in occupational areas and in specific occupations were not significant for prediction, tested against either criterion.

The judges' ratings of scholastic aptitude and total estimate of probable success were significant beyond the 1% level for both criterion. The general mental ability ratings

were significant for predicting the outcome-of-training only, while measured interests were found to be not significant for either criterion.

The values were exceptionally high in the study of the relationship between the judges' and the author's ratings of selected determinants and the total estimate of probable success in college.

It was concluded that, within the limitations of this study, counselors' over-all recommendations for or against college training were highly predictive of success or failure, but were not significant for scholastic achievement. Counselors most frequently based their recommendations on factual, rather than judgmental, data.

The specific determinants which were statistically significant in predicting both the outcome of college training and the honor-point ratio were scholastic aptitude test results, the college scholastic record, and the total numbers and weights of specific determinants, both favorable and unfavorable. Measured interests, general mental ability, and clerical aptitude test results, as well as measures of achievement in specific fields, were predictive only of the outcome-of-training.

The non-specific determinant, estimate of personality, was significant in predicting the outcome-of-training, as were the total numbers and weights of all non-specific determinants.

The judges showed a high degree of competence in predicting the outcome-of-training, and in using scholastic aptitude test results and total estimate of success to predict honor-point ratios. Neither they nor the author were successful in using measured interests for predictive purposes.

The results of the techniques used in this study indicate that counselor recommendations may be successfully evaluated by assigning weights to the determinants used in making recommendations; and that the value of over-all recommendations and individual determinants can be more clearly disclosed by the use of multiple criteria.

141 pages. \$1.76. Mic 56-599

A STUDY OF THE PERSONALITY OF NORMAL AND SCHIZOPHRENIC ADOLESCENTS USING TWO PROJECTIVE TESTS: A DIFFERENTIATION ON THE BASIS OF STRUCTURAL AND BEHAVIORAL RIGIDITY USING THE LOWENFELD MOSAIC AND RORSCHACH TESTS

(Publication No. 15,563)

Claire M. H. Brody, Ph.D.
New York University, 1955

This investigation was concerned with the clinical differentiation of two groups of adolescents: twenty hospitalized adolescents diagnosed as schizophrenic and twenty well-adjusted high school pupils. The groups were matched for sex, age, I.Q., educational level, place of birth and recent geographical residence. Personality rigidity, as indicated in reactions to two projective tests - the Lowenfeld Mosaic and Rorschach Tests - was the criterion of differentiation.

A Scale of Rigidity was constructed for each of the two tests. It consisted of indices of rigidity for the tests suggested by the literature as well as original test measurements. The hypotheses tested were that there would be a

significant difference in the scores on the Scales of Rigidity for the two tests, between the schizophrenic and control groups; that the differences in response between the first and second, the first and third, and the second and third administrations of the Lowenfeld Mosaic Test would be significantly higher in the control group, i.e., there would be greater rigidity in the schizophrenic group.

The Sign Test was used to test for significance. The values obtained for the schizophrenic and control subjects were tabulated for the eight items of the Lowenfeld Scale and the ten items of the Rorschach Scale. A plus or a minus sign was assigned for each of the Scale items of the two tests, for each subject, on the basis of the cut-off point for each item that was decided beforehand.

Results indicated that the Scales of Rigidity which were developed for the two tests did differentiate the groups at a highly significant level (beyond the 1% level of confidence). In contrast to this, repetition of the projective test stimulus (successive administrations of the Mosaic Test) as a means of tapping personality rigidity, did not differentiate the groups significantly.

Several explanations for this were offered. First, it was questioned what, exactly, the Lowenfeld Mosaic Test Scale of Rigidity tapped. While the Scale may, ostensibly, have been investigating what we chose to call "rigidity" in the first administration, by altering the situation, the inherent lability of the subject may have been elicited. In addition, adolescent schizophrenics may be considered to still be in a state of personality flux, with perseverating tendencies not as well established as in the adult. In fact, one item of the Scale purporting to test perseveration directly, showed a greater tendency in this direction for the Control subjects. Perseveration was actually an area of overlapping between the normal and schizophrenic adolescents. This is consistent with a psychological orientation which describes schizophrenia in adolescence as but one extreme on the continuum of behavior maladjustment.

It was suggested further that the variability and flexibility apparent in the schizophrenic subjects emphasized the state of flux they were in. As such it could be considered a positive sign and have favorable implications for therapy.

162 pages. \$2.03. Mic 56-600

AN EXPERIMENTAL INVESTIGATION OF PERCEPTUAL BEHAVIOR IN SCHIZOPHRENICS

(Publication No. 13,009)

Louis Peter Carini, Ph.D.
Clark University, 1955

This thesis was concerned with an experimental study of the perceptual behavior of schizophrenics. The investigation was carried out within the frameworks of developmental theory and of the sensory-tonic field theory of perception.

Sensory-tonic theory is an organismic theory of perception. Its central assumption is that perception mirrors relationships between organism and object. In integrating a basic principle of developmental theory, viz., the principle of increasing differentiation, with the basic tenets of sensory-tonic theory, we may state that there is an increasing

differentiation in this relationship between organism and object with increasing age. A further assumption of developmental theory used here is that of regression or primitivization in schizophrenia, i.e., there is a lack of differentiation in the relationship of the organismic state and the stimulus object in schizophrenia.

Accordingly, a hypothesis was formulated stating that the perceptual behavior of schizophrenics would be regressed. That is, the perceptual behavior of schizophrenics would be similar in certain respects to that of children. Furthermore, on the assumption that catatonic-hebephrenic schizophrenics, paranoid schizophrenics and normal adults are on a genetic continuum with respect to the body-object relationship, it was expected that a relatively greater degree of primitivization or regression would occur with catatonic-hebephrenic schizophrenics compared with paranoid schizophrenics.

Five experiments were carried out in the area of spatial localization, viz., the effect of extraneous stimulation (body tilt) on apparent verticality, the effect of object stimulation on the position of the apparent vertical and on the position of the apparent median plane, and the effect of directional dynamics on the position of the apparent median plane and on the position of the apparent horizon. In addition, an experiment was included to test the efficacy of intersensory relationships, viz., the effect of extraneous auditory stimulation on critical flicker frequency. All of these experiments were conducted in a manner identical to those previously utilized in a developmental study conducted at Clark University with children between the ages of 6 and 19. These studies provided comparative data for the evaluation of the hypothesis of regression in schizophrenia.

Forty-eight subjects, 16 normal adults, 16 paranoid schizophrenics and 16 catatonic-hebephrenic schizophrenics, were tested in each of the experiments on spatial localization; these forty-eight subjects and six additional subjects, 18 in each of the three groups, participated in the experiment on the effect of tone on cff.

For several of the areas investigated, there was no evidence to suggest that schizophrenics differed from normals. In a number of situations, however, clear cut differences between schizophrenics and normals were found. These situations were those where postural factors entered into spatial localization as primary factors; such postural factors were either directly manipulated - as in the experiments on body tilt - or exerted an influence in terms of relatively permanent asymmetric sensory-tonic distributions - as reflected in systematic directional deviations of the apparent median plane and of the apparent horizon.

With regard to the effect of body tilt on the position of the apparent vertical, it was found that for normal adults the position of the apparent vertical was relatively opposite the side to which the body was tilted; in contrast, for the schizophrenics, the position of the apparent vertical was located relatively to the side of body tilt. Moreover, the position of the apparent vertical was located to a greater degree in the body tilt for the catatonic-hebephrenic than for the paranoid schizophrenics. The findings concerning the position of the apparent vertical for schizophrenics parallels that obtained for young children in the developmental study conducted at Clark.

The differences between schizophrenics and normals obtained with respect to systematic directional deviations on the positions of the apparent median plane and the apparent horizon parallel - in the direction of regression - the ontogenetic changes found in children. That is, the position of

the apparent median plane was significantly to the left for the schizophrenic groups compared with normals. The position of the apparent horizon was significantly higher for the catatonic-hebephrenic group compared with the normal group. Furthermore, the apparent horizon was physically located highest for catatonic-hebephrenic schizophrenics, intermediate for paranoid schizophrenics, and lowest for normal adults.

The findings lead to the conclusions that schizophrenics showed regressive trends, i.e., differed from normals and were similar to children in perceptual situations which involve either relatively permanent postural configurations or direct variation of postural factors. If one formulates these conclusions within the framework of sensory-tonic field theory of perception, it can be stated that in this study evidence was found for regressive trends in those situations where spatial localization is influenced by extraneous stimulation, i.e., stimulation from a source other than the object attended to.

112 pages. \$1.40. Mic 56-601

THE ROLE OF MEANING, FREQUENCY OF CONTACT AND AUDITORY-VOCOMOTOR STIMULATION IN THE VISUAL PERCEPTION OF VERBAL STIMULI

(Publication No. 12,678)

Thomas J. Edwards, Ph.D.
Temple University, 1955

The design of this experiment was planned for the purpose of studying the factors of meaning, frequency of contact and auditory-vocomotor stimulation as they affect the visual perception of verbal stimuli. A 3 x 3 x 2 factorial design was employed in order simultaneously to determine the effects of the three variables separately and in combination with each other. There were three conditions of meaning and of frequency and two conditions of auditory-vocomotor stimulation.

One hundred twenty-six college freshmen and sophomores were divided among the 18 experimental procedures. These groups were equated for learning ability and vocabulary development on the basis of the ACE and vocabulary section of the Nelson-Denny respectively. An analysis of variance revealed no significant variation among the groups on either of these tests. The subjects also had to meet minimum vision requirements.

In order to control the factors of meaning, frequency of previous contact with the stimuli and auditory-vocomotor stimulation, a preliminary study was made to test 99 specially constructed two-syllable, pronounceable nonsense words to determine their association values. Fifteen of these dissyllables with low association values were selected for the main experiment and common meanings were assigned to them from the Thorndike-Lorge frequency list.

Each procedure was divided into a learning part and a testing part. The learning part involved no meaning, motivated meaning or unmotivated meaning. Each one also involved five, ten or fifteen one-second tachistoscopic presentations of the stimuli and either the presence or absence of auditory-vocomotor stimulation. The testing part of each procedure involved 1/200 second tachistoscopic exposures

of the stimuli with the subjects attempting to reproduce them correctly.

Scores were derived from the number of presentations required before the subject made two correct reproductions of each stimulus. The correct responses were not tallied in the total score.

Analysis of variance and subsequent *t*-tests were used to study the scores resulting from the 18 procedures. The 3 x 3 x 2 factorial table containing the 18 cells with their means was handled by three methods involving certain exclusions and combinations of cells.

There were three conditions of meaning: the absence of meaning, motivated meaning and unmotivated meaning. No one of these conditions showed significant variation or interaction by any of the three methods of studying the data. Apparent but insignificant differences were noted among the three conditions with motivated meaning seeming to have the best effects upon perceptual development. The no-meaning condition appeared to be the second most effective and the unmotivated meaning seemed least effective.

When the error variance contributed by the no-meaning condition was eliminated, the analysis of variance yielded an *F*-ratio between motivated and unmotivated meaning which very closely approached significance.

Frequency of presentation also varied three ways: five, ten and fifteen presentations of the stimuli. The analysis of variance revealed significant differences among these three conditions of frequency, with the *t*-tests showing that a significant gain was made between five and ten presentations but not between ten and fifteen.

The analysis of variance also showed significant interaction between frequency and auditory-vocomotor stimulation. Subsequent *t*-tests indicated that five presentations without auditory-vocomotor stimulation were significantly worse than the other two frequencies, regardless of the presence or absence of auditory-vocomotor stimulation. The five presentations without auditory-vocomotor stimulation were also significantly inferior to the five-presentations in which auditory-vocomotor stimulation was present. From this it may be seen that auditory-vocomotor stimulation had a significant facilitating effect upon perception when there were only five presentations of the stimuli. When presentations were increased to ten or fifteen, frequency became potent enough in itself to facilitate perceptual development and auditory-vocomotor stimulation ceased to reveal any significant function. There was no significant difference between any two of the three conditions of frequency when auditory-vocomotor stimulation was present in each one. Also, there was no significant difference between ten and fifteen presentations, regardless of the condition of sensorimotor stimulation at either frequency level. There was an unreliable tendency for perception scores to become worse as frequency progressed from ten to fifteen when auditory-vocomotor stimulation was absent.

The two conditions of auditory-vocomotor stimulation did not differ significantly between themselves when all the other conditions of the experiment were present.

100 pages. \$1.25. Mic 56-602

THE INTER-RELATIONSHIPS BETWEEN MANIFEST ANXIETY AND CERTAIN BEHAVIORAL AND DESCRIPTIVE VARIABLES

(Publication No. 14,395)

Louise Evans, Ph.D.
Purdue University, 1955

Major Professor: John M. Hadley

The purpose of this investigation was to compare the relationships between manifest anxiety and certain personality and descriptive variables in a population with diagnosed functional behavior disorders and in a population with no known psychiatric illnesses.

Two paper and pencil personality tests, the Biographical Inventory and the Multiple Choice Sentence Completion Test were modified for use in the present study. The personality variables operationally defined and measured by the tests were: manifest anxiety, rigidity, dishonesty, constriction, social conformity, withdrawal, aggression, passive-dependency, and inaction. In addition, a personal data sheet was used to obtain information on the descriptive variables of age, sex, present marital status, education and occupation. The tests were administered to two groups of subjects.

A sample of 83 patients were selected on the criterion of psychiatric judgment as representing extremes (high and low) in level of manifest anxiety. The control group was comprised of 83 volunteers from a variety of clubs and organizations. The two samples included both sexes, and covered a wide age, educational, and occupational range.

Pearson product-moment correlation coefficients were computed between the personality and descriptive variables for each group separately, and analyzed factorially by the Multiple Groups method. Rotation of the orthogonal factor loadings to "simple structure" (except for considerations of psychological meaningfulness) yielded a set of six factors for each sample.

Factor I identified as a social status factor was isolated in both the psychiatric and non-psychiatric groups. Corresponding relationships between the factor loadings was found on Factors I of both samples. Factor II is a manifest anxiety factor which was identified in the psychiatric group by the high positive loadings on the manifest anxiety scale and the psychiatric anxiety ratings. The Taylor Scale of manifest anxiety was found to have substantial validity in the psychiatric group. The scale correlated .83 with the psychiatric judgments of high or low level of overt anxiety. A manifest anxiety factor was created in rotation to play the same role in the non-psychiatric group. The relationships between the variables loading on Factor II, the manifest anxiety factor in both groups, was essentially the same with a few significant exceptions. The major differences were the positive loading of aggression on the anxiety factor in the non-psychiatric group; and the negative loading of passive-dependency on the anxiety factor in the psychiatric sample. Factor III in the psychiatric group was identified as a factor of inhibition and non-aggression. In the non-psychiatric group Factor III was identified as a factor of inhibition and non-passive-dependency. Factors III in both groups were highly comparable because of their high positive loadings on inaction and constriction and their negative loadings on aggression. Some important differences were noted in the relationships between the variables loading on this factor in

both groups. Factor IV in the psychiatric group was defined by high loadings on the sex variable and the lie scale. It did not correspond with any of the factors in the non-psychiatric group. Factor IV in the non-psychiatric group was defined as a factor of withdrawal and non-aggression. There appeared to be no corresponding factor in the psychiatric group. Factor V in the psychiatric group was identified as a rigidity factor. In the non-psychiatric group Factor V was considered to be a sample characteristic since it was defined by high loadings on the sex and age variables. However, the positive loadings of age and rigidity on this factor made it partially comparable to Factor V in the psychiatric group. Factor VI in the psychiatric group was defined as a factor of withdrawal and non-passive-dependency. No corresponding factor was identified in the non-psychiatric group. Factor VI in the non-psychiatric group was identified as a factor of social conformity and had no correspondence with any of the factors identified in the psychiatric group.

Since the goal of this study was to explore relationships rather than to identify personality parameters, factor analytic procedure was used only as a convenient tool for summarizing and describing the data. Psychological interpretations were offered about the inter-dependent relationships between the set of personality and descriptive variables loading on a factor and about the nature of a particular factor. The results of this study have implications for further research. 139 pages. \$1.74. Mic 56-603

**CHANGES IN TWO GROUPS OF INSTITUTIONALIZED
MENTALLY RETARDED DELINQUENT BOYS
FOLLOWING A SERIES OF INDIVIDUAL AND
GROUP BLAME-AVOIDANCE INTERVIEW
SESSIONS: THE EVALUATION OF CHANGES
IN SELF-CONCEPT, IN ATTITUDE TOWARD
OTHERS, AND IN CERTAIN ASPECTS OF
INSTITUTIONAL BEHAVIOR AND ADJUSTMENT**

(Publication No. 15,564)

Samuel W. Gluskin, Ph.D.
New York University, 1955

The purpose of this study was to evaluate the changes in institutional behavior and adjustment, in attitude toward others, and in attitude toward self among three groups of institutionalized mentally retarded delinquent boys following a series of individual and group blame-avoidance interview sessions.

Two experimental groups and a control group of ten subjects each were formed. The subjects were randomly selected on the basis of consecutive admissions to Annandale Reformatory. They were between the ages of 16 and 25 and had I.Q.s which ranged from 50 to 75.

Pre and post evaluations were made of each subject's work marks, number and severity of infractions of institutional rules, and general behavior as assessed by his cotage officer. In addition, an evaluation in terms of desirable and undesirable attitudes toward self and others were made by three independent judges on the basis of data derived from the Thematic Apperception Test and from a modification of the Sack's Sentence Completion Test.

The members of one experimental group (Group A) participated in two one-half hour individual interview sessions per week during a fifteen-week period. The other experimental group (B) participated in weekly group sessions of one hour's duration during the same period. The Control Group (C) took part in none of the interview sessions. All three groups followed the standard institutional training and work program.

The terminal evaluation revealed significant mean differences in work marks, disciplinary reports, institutional adjustment and attitude toward others between Groups B and C, and significant mean differences in attitude toward others and attitude toward self between Groups A and C. The direction of these differences indicated that the Control Group was less favorably adjusted on the above-named variables at the conclusion of the study than were either Group A or Group B.

The results indicated that those boys who participated in the interview sessions maintained their previous levels of adjustment or tended to become more favorably adjusted. However, the Control Group showed no gains. Statistically significant results were obtained to show that this group as a whole failed to adjust to the institutional routine with indications that their behavior and attitudes became more undesirable during the period of their incarceration.

The effectiveness of the society-oriented method of interviewing proved to be partially successful with mentally retarded delinquents. Success was noted in the efficacy of this method of interviewing in stimulating emotional expression. Limited success was noted in the area of understanding. Catharsis, rather than insight, was of greater value in motivating the changes that were noted.

The results of this study demonstrated the possibility of achieving positive therapeutic results with the mentally retarded provided that limited goals are set and that a greater degree of patience and understanding is exerted by the counselor.

The Thematic Apperception Test was unsatisfactory in discriminating attitudinal differences among the subjects. The Sentence Completion Test was more effective in stimulating meaningful responses which were consistent with the material in the subject's background.

The data did not reveal any relationship between the boys' attitudes and their subsequent behavior. Some of the boys who made a favorable adjustment failed to improve their attitudes. Other boys who revealed an increase in favorable attitudes failed to improve their adjustment.

The findings in this research are in general agreement with those of other investigators in the fields of correction and mental deficiency. The results demonstrated the importance of modifying the existing program at Annandale to provide an opportunity for the mentally retarded delinquent to express his feelings and emotions without fear of reprimand or ridicule. 305 pages. \$3.81. Mic 56-604

AN INVESTIGATION OF SYMBOLIC REPRESENTATION IN SCHIZOPHRENIA

(Publication No. 13,013)

Alfred Emmanuel Goldman, Ph.D.
Clark University, 1955

The purpose of the present investigation was to compare symbolic functioning in schizophrenics and normals, and to relate our findings to the general principles of development.

Our theoretical approach has been one which focuses on the formal aspects of symbolic activity in contrast to its functional or psycho-dynamic properties; and further, conceives of symbolic functioning as undergoing a genetic progression during the normal course of development, and a reversal of this progression in pathology.

The aspects of symbolic representation which were selected for analysis were: Consensuality of symbolic expression and three other aspects which appeared to underlie consensus, namely, univocality, autonomy, and modes of representation. Consensuality is defined as the degree of uniformity with which members of a group expressed affective meanings. Univocality refers to the relative stability of the symbol-referent relationship, that is, the degree of consistency with which an individual uses a symbol to represent the same meaning. The third aspect, Autonomy, concerns the degree to which the meaning of a concept is independent of concrete contexts. Finally, Modes of Representation concern the extent to which symbols pictorially represent the concepts to which they refer.

Empirical data provided by studies of symbolic functioning in children, primitive peoples, pathologically primitivized organisms, and normal adults in states of lowered awareness, suggested that each of the four aspects which were selected for analysis could be ordered with respect to developmental levels. Accordingly the following four hypotheses were formulated.

1. Consensuality. The degree of intersubjective uniformity in the expression of mood-terms is expected to be lower among schizophrenics than normals.
2. Univocality. The degree of intrasubjective uniformity in the expression of mood-terms is expected to be lower among schizophrenics than normals.
3. Autonomy. Schizophrenics are expected to represent the meaning of affective words in terms of concrete contexts more frequently than normals.
4. Modes of Representation. Schizophrenics will represent abstract mood-terms by pictorial symbols more frequently than normals.

In order to evaluate these hypotheses, we employed a method in which mood-terms are expressed through the medium of lines. In the linear-schematization task the subject was required to draw lines which best express various mood-terms. In the response-equivalence task, the subject had to match mood-terms and lines of different structural characteristics. In this way we sought to bring to light the processes involved in symbolic representation — processes which, it was felt, are generally obscured by the linguistic code.

The statistical evaluation of the data provided by this study appear to support the four hypotheses and suggest the following conclusions:

1. Schizophrenics are more idiosyncratic in their expression of mood-terms than normals.

2. Equivocality of symbolic expression is greater among schizophrenics than normals. In particular, there is a tendency, in schizophrenia, to represent antonymic mood-terms by the same symbol.
3. For schizophrenics in comparison to normals the meaning of concepts refers more frequently to personally relevant concrete contexts; while meaning for normals is more frequently autonomous of contexts.
4. Symbols are pictorial representations of concepts more frequently for schizophrenics than for normals; while for normals symbols are characteristically apictorial, i.e., abstractive, representations of their referents.

These conclusions were discussed in relation to the general principles of development, according to which there is an increase in differentiation of symbolic functioning during development and, conversely, a dedifferentiation of symbolic functioning in schizophrenia.

98 pages. \$1.23. Mic 56-605

AN INVESTIGATION OF THE PSYCHOANALYTIC THEORY OF PSYCHOSEXUAL GENESIS OF PARANOID SCHIZOPHRENIA

(Publication No. 15,567)

Charles Nicholas Kapotas, Ph.D.
New York University, 1955

The purpose of this study was to investigate the relationship between the paranoid schizophrenic disorder and repressed homosexual conflicts, and the internal consistency of the psychoanalytic theory of psychosexual genesis as it relates to the paranoid disorder.

Freud and several of his followers hypothesized that paranoia and the paranoid disorder are characteristic of individuals suffering from repressed homosexual conflicts. In addition they hypothesized that anal-sadistic fixations and conflicts tend to play a major role in the development of these disorders. Great significance was also attached to the role of the projective mechanism. Other theorists since that time have stressed that oral conflicts and fixations also tend to play an important role in their development. Further, great significance has also been attached to the role which feminine, or confused, identification tends to exert in the development of paranoia and paranoid schizophrenia.

Since the original formulation of the theory by Freud many clinical investigations have been conducted in an attempt to substantiate or refute the Freudian hypothesis of a relationship between paranoia and repressed homosexual conflicts. Most of these studies have tended to confirm that a relationship exists between paranoia and homosexuality. Relatively few psychological studies with adequate control groups have been conducted in the realm of this problem. The purpose of this investigation was to explore the nature of the relationship between the paranoid disorder and repressed homosexual conflicts by means of psychological instruments and techniques.

The experimental design of the study consisted of sampling a large group of paranoid and non-paranoid schizophrenics hospitalized in a state mental institution. An experimental group consisting of thirty subjects who were psychiatrically diagnosed as paranoid schizophrenics and a control group consisting of thirty subjects who were diagnosed as catatonic, simple, or hebephrenic schizophrenics were utilized in this investigation. Their responses to a battery of psychological tests designed for getting at their psychological functioning were compared. The Blacky Pictures Test, the Rorschach Test, and a Sentence Completion Test designed by the investigator so as to assess attitudes toward sex and women were utilized in this study.

The following results were obtained:

The paranoid schizophrenic group responded with an average of 5.33 homosexual responses (range 1-12 responses) and the non-paranoid schizophrenic group responded with an average of 3.19 homosexual responses (range 1-6) on the Rorschach Test.

The Chi-Square technique for testing hypotheses was used to evaluate the results which were obtained with the Sentence Completion and Blacky Pictures Tests.

The results which were obtained with the Sentence Completion Test tended to reflect great variability of performance in both groups of subjects with respect to their attitudes toward sex and women.

The paranoid schizophrenic group tended to exhibit evidence of stronger underlying oral-sadistic ($P = .01$), analsadistic (retentive) conflicts ($P = .01$), Oedipal intensity ($P = .02-.05$) and masturbatory guilt feelings ($P = .05-.10$), than the non-paranoid schizophrenic group on the Blacky Pictures Test.

Of forty inter-dimensional comparisons made for each group of subjects thirteen were found to be correlated in the paranoid group and nineteen in the non-paranoid group.

The following conclusions were reached:

The course of the libidinal and love-object development differs in paranoid and non-paranoid schizophrenics.

Both paranoid and non-paranoid schizophrenics manifest homosexual conflicts.

Paranoid schizophrenics exhibit greater evidence of confusion in sexual identification than non-paranoid schizophrenics.

Non-paranoid schizophrenics exhibit evidence of psychosexual disturbances.

Non-paranoid schizophrenics exhibit evidence of an earlier or deeper ego and libido regression than paranoid schizophrenics.

The investigator recommends that further studies be conducted in this area. 146 pages. \$1.83. Mic 56-606

DIFFERENCES IN TEST BEHAVIOR BETWEEN PARANOID AND NON- PARANOID SCHIZOPHRENIC GROUPS

(Publication No. 14,727)

John Denis Murati, Ph.D.

The University of Wisconsin, 1955

Supervisor: Professor A. H. Edgerton

Statement of the Problem

Twenty acute paranoid schizophrenics are matched by group with twenty non-paranoid schizophrenics by age, vocabulary score on the Wechsler-Bellevue Vocabulary subtest, years of education, and other social factors to minimize cultural differences. The primary difference is the demonstration of paranoid behavior by the first group. It is anticipated that the groups are significantly different in behavioral reactions concerning reality testing, aspiration level and rigidity. Both groups are given the Rorschach Test and a level of aspiration test to discover if differences of this nature exist.

Procedure

The level of aspiration test operationally defines the experiment situation in terms of reality testing, aspiration level and rigidity. The Rorschach F + and D% are presumed to measure reality on one level and P that on another. The corresponding level of aspiration scores are the Goal Attainment and Conventional scores. The Rorschach W% and R, number of responses, are presumed to measure aspiration level and the corresponding scores from the objective level of aspiration situation are the Goal Discrepancy and Negative scores. The measures for rigidity on the Rorschach are F% and A% and on the level of aspiration: Repetition, Shift, and Unusual scores.

The level of aspiration test employed is a modification of the printing test developed by J. D. Frank utilizing control procedures employed by Rotter. The administration and scoring of the Rorschach closely followed Beck's system

| Results | | | |
|------------------------|--------------------|------------------------|--------|
| Measure | Paranoid N = 20 | Non-paranoid N = 20 | t |
| <u>Reality Testing</u> | | | |
| F+ | 79.15 + 13.50 | 54.10 + 24.01 | 4.07** |
| D% | 53.15 + 23.81 | 47.45 + 21.71 | .80 |
| Attainment | 25.90 + 26.49 | 8.95 + 24.65 | 2.11* |
| P | 4.25 + 1.90 | 2.65 + 1.62 | 2.87* |
| Conventional | 1.90 + 1.66 | 1.95 + 1.32 | .01 |
| <u>Aspiration</u> | | | |
| W% | 44.00 + 26.37 | 43.35 + 23.01 | .09 |
| R | 16.70 + 7.21 | 15.25 + 6.20 | .70 |
| Discrepancy | -16.90 + 25.62 | + 2.25 + 27.43 | 2.28* |
| Negative | 5.50 + 2.80 | 4.85 + 2.29 | .20 |
| <u>Rigidity</u> | | | |
| F% | 83.95 + 12.70 | 89.95 + 10.60 | 1.62 |
| A% | 50.10 + 17.20 | 52.80 + 25.94 | .40 |
| Repetition | 2.75 + 1.97 | 3.25 + 2.28 | .71 |
| Shift | 2.60 + 1.74 | 2.85 + 1.48 | .30 |
| Unusual | .90 + 1.13 | .80 + 1.09 | .30 |

* 5% level of confidence ** 1% level of confidence

with the addition of a standardized inquiry and the computation of an F% rather than the lambda index.

Conclusions

1. In the level of aspiration method the scores expressed in units proved more discriminating than those expressed in terms of absolute count.
2. Paranoid Schizophrenics were significantly different in reality testing on the Rorschach indicators F + and P and the level of aspiration Goal Attainment Score. D% and Conventional scores did not differentiate.
3. Only the Goal Discrepancy Score differentiated between groups on aspiration level. The Rorschach W% and R and the level of aspiration negative score did not differentiate between the kinds of aspiration displayed in the experiment.
4. No real differences appeared in the rigidity scores of the Rorschach or the level of aspiration test. The only conclusion that can be drawn is that within the confines of the test situation, for whatever reason, the groups displayed similar behavior as measured.

54 pages. \$1.00. Mic 56-607

EFFECT OF ANXIETY, MOTIVATIONAL INSTRUCTIONS, AND FAILURE ON SERIAL LEARNING

(Publication No. 14,666)

Irwin Gerald Sarason, Ph.D.
Indiana University, 1955

The present study dealt with the effect of three personality variables on performance in a serial learning situation. One of these variables was anxiety which was defined as score on the Taylor Anxiety Scale. The two experimentally manipulated variables were differential motivating instructions and failure or non-failure reports.

The subjects were 180 students in introductory psychology at Indiana University. These Ss were divided into 12 groups each representing a unique combination of the three variables studied. The high anxious Ss were selected from the upper 10% of the Taylor Scale distribution. The low anxious Ss were selected from the lower 10% of the distribution. The middle anxious Ss were drawn from the 45th to 55th percentiles. All Ss used had T scores under 70 on the L and K scales of the MMPI.

Using a Hull type memory drum and the anticipation method, 2 lists of 17 nonsense syllables each were presented to Ss with a 2 second exposure per syllable, and a 6 second intertrial interval. Each list was composed of syllables randomly selected from a list of nonsense syllables of 73% association value.

Each S was given 15 trials on an initial list. Following this, Ss in the three anxiety groups were randomly assigned to receive high or low motivating instructions. The high motivation instructions included a statement that the serial learning task was an intelligence test. The low motivating instructions stated that the list of syllables was a second practice list. After verbal administration of these instructions all groups received 14 trials on the experimental list, following which the Ss in each group were randomly assigned

to one of two conditions: one condition, failure, consisted of verbally informing the S that he had failed; while the other, or neutral, condition, consisted of an equal interval of neutral conversation with S. After the failure or neutral condition, each S was given one more trial on the experimental list. Twenty-four hours later each S was given 6 more trials on the experimental list.

The measure employed in statistical tests was the number of correct anticipations on a given trial. A three factor analysis of variance design was employed with high, middle, and low anxiety; high or low motivating instructions; failure or non-failure reports. The results revealed that high motivational instructions were detrimental for high anxious groups and facilitating for low and middle anxious groups. Further, the interaction between anxiety and motivational instructions continued to be significant 24 hours after administration of the motivational instructions. The performance of failed Ss was found to be poorer than that of non-failed Ss immediately after administration of failure reports; however, 24 hours later the effect of failure had completely dissipated. At no time did the high, middle, and low anxious groups perform differently on the basis of the anxiety variable alone.

The results were taken as a further verification of the influence of individual difference variables (e.g., anxiety) on performance. Two interpretations of the results were considered: one emphasized associative factors involved in the learning of certain detrimental responses by high anxious individuals, while the other interpretation stressed the motivational or drive aspects of anxiety.

58 pages. \$1.00 Mic 56-608

A CLINICAL INVESTIGATION OF CERTAIN PERSONALITY CHARACTERISTICS OF TWENTY ADULT MALE EXHIBITIONISTS

(Publication No. 13,640)

Herman H. Spitz, Ph.D.
New York University, 1955

The Problem

The purpose of the present investigation was to examine and evaluate the personality characteristics of each of twenty exhibitionists, to find the relationships of these personality characteristics to the act of exhibitionism, and to reveal any general personality characteristics common to all twenty exhibitionists which might set them apart from another offender group.

The Method

The subjects were institutionalized exhibitionists consecutively chosen and ranging in age from 20 to 44. A control group of sexual assaultists was closely equated in age with the exhibitionists.

The method of investigation was as follows: Each subject's social history was extracted from his institution folder. Each subject was then interviewed and given a battery of psychological tests by the experimenter. This battery included the Wechsler-Bellevue Intelligence Scale, Form II; the Rorschach test; the Thematic Apperception

Test; and a series of figure drawings including a house, a tree, a person and a person of the opposite sex. An autobiography was requested from each subject.

Data gleaned from each social history, interview and autobiography were utilized in securing pertinent background and historical material on each subject.

Mental levels taken from the Wechsler-Bellevue Test results were listed.

Scores on the following Rorschach scoring categories were extracted from each subject's test protocol and interpreted: Number of Responses, F%, A%, Number of Populans, Number M, Number FM and Sum C, in addition to relevant content responses.

The roles of the identification figure on each Thematic Apperception Test story were rated by the experimenter plus two raters on the following categories: Passive, Assertive, Dependent, Independent, Successful, Unsuccessful, and Other. On the basis of agreement by two out of three raters the final "hero" roles were tabulated. The stories were also qualitatively evaluated by the researcher and presented in digest form.

The heights and ages assigned by the subjects to their male and female figure drawings were listed.

In order to evaluate the personality characteristics of each exhibitionist, each method of personality appraisal was evaluated separately, then combined in a final summary on each subject. Attention was paid to etiological factors in the act of exhibitionism, and to any evidences of such personality traits as passivity, inhibition, immaturity and dependency.

The Results

The exhibitionists of this study are found to be — principally on the basis of Rorschach Test results — severely emotionally inhibited to a point where this personality characteristic significantly differentiates them from a control group of sexual assaultists.

Passivity, immaturity, shyness and dependency are frequently found traits in the exhibitionists, but these traits do not significantly differentiate them from the control group. Within and beyond this framework, the exhibitionists show varying individual personality characteristics. They vary in intelligence as does a normal population.

The act of exhibitionism is broadly defined as an act of restitution which satisfies at the moment of exposure particular needs of the exhibitionist, usually centering around the need for appreciation as a competent and virile male, and the need to compensate for lowered self-esteem. There is some evidence that the expression of hostility is a component part of the act. Within this framework of restitution there are as many unique motivating forces to the act of exhibitionism as there are exhibitionists.

The exhibitionists come from faulty family environments, with the mothers or mother-surrogates often overdomineering and/or over-protective. Subjects frequently have an inordinate need to please or be appreciated by significant figures in their early lives. They have difficulty in relating to the opposite sex, and often harbor covert hostility toward women. Fathers, or father-surrogates, are usually poor identification figures.

326 pages. \$4.08. Mic 56-609

THE RELATIONSHIP OF MASCULINITY-FEMININITY SCORES TO TEMPERAMENT AND INTEREST PROFILES

(Publication No. 12,403)

Harry Joseph Woehr, Ph.D.
Temple University, 1955

This investigation was devoted to a statistical analysis of the relationship between masculinity and femininity traits of college males as indicated by paper and pencil indicators and the interests and other personality characteristics of this group. The Guilford-Zimmerman Temperament Survey was used to measure masculinity and femininity and personality traits. The measurement of interests was done with the Strong Vocational Interest Blank. The purpose was primarily to broaden the knowledge in this area of personality and interest testing so that it might be used more effectively in counseling situations.

The following specific problems were investigated: (1) What are the measured interests of men who have high "masculine", as compared to those who have low masculine (feminine) scores? Moreover, does the Strong-Vocational Interest Blank for Men measure the interests of males in a sufficiently comprehensive manner? (2) What are the relationships between the scores on scales common to the Men's and Women's Blanks of the Strong Vocational Interest Inventory? (3) How is masculinity-femininity of interest and emotion related to other factors measured by the Guilford-Zimmerman Temperament Survey?

The population for this study was composed of 163 male students in the undergraduate college of Temple University. All subjects volunteered to participate in the investigation and were enrolled in psychology classes at the time the data were collected. The subjects range in age from 17 to 42 years.

The Strong Vocational Interest Blanks for Men and Women and the Guilford-Zimmerman Temperament Survey were administered to all subjects. The Strong was always administered first with the Male Blank being used in the initial testing phase. This was followed at a second testing situation with the Female Blank. The instructions for this blank were as follows: "You are to take the Women's Blank of the Interest Test you took yesterday. As you take the test judge whether you would enjoy the task that is involved. Do not attempt to assume you are a female! Merely judge the task involved." The final test administered by individual appointment was the Guilford-Zimmerman Temperament Survey.

The conclusions drawn are considered to be tentative and applicable only to the population that was investigated. Interpretations of the findings should be cautious and within the framework of the limitations of the present study.

I. In regard to the interests of men who rate themselves masculine and those who rate themselves feminine: definite differences were obtained in the keys favored by these two groups as follows: The High Masculine Group favored Production Manager, Architect, and Mathematician (Male Blank); and Business Education Teacher, Dentist, Mathematics-Science Teacher and Lawyer (Female Blank). The Low Masculine Group favored City School Superintendent, Musician, Social Science Teacher, Y.M.C.A. Secretary and Advertising Man (Male Blank). These differences are all statistically significant.

II. In regard to the correlation between those scales which are common to the Male and Female Blank it was found that: (1) Using the customary criterion (A and B+ ratings) significant association was found for five of the eleven common keys, — of these, only one showed a high correlation. (2) Using the "chance criterion", ten of the common keys showed a significant association, — of these, only four showed a high correlation.

Further research is needed to clarify this problem — particularly as regards the relative validity of the two possible criteria, especially in the use of the test in counseling.

III. With regard to the relation between Masculinity-Femininity and other personality traits: The correlation between personality traits and masculinity-femininity does not reveal any definite pattern of interests for either the High Masculine Group or the Low Masculine Group. It was seen that the High Masculine Group rated itself more objective, more emotionally stable and showed a tendency to rate itself more cooperative. This did not prove highly significant statistically but it is in agreement with previous studies that produced similar findings, Felzer. Tentatively it may be concluded that masculinity-femininity as measured by the tests used is not related to other personality traits measured by them.

No definite pattern of personality for either the Low Masculine Group or the High Masculine Group appears in these findings. Such a finding suggests that Masculinity and Femininity as measured by the paper and pencil tests used in this study is not a quality or trait that is reflected in other personality traits of an individual. Masculinity-Femininity appears more likely to be reflected in the occupational choices. This aspect should be investigated further also.

It was found that the two measures of masculinity-femininity, one on the Strong and the other on the Guilford-Zimmerman Temperament Survey, correlate highly and thus appear to be measuring the same aspect or trait of an individual although Strong and Guilford define them differently.

92 pages. \$1.15. Mic 56-610

PSYCHOLOGY, EXPERIMENTAL

THE EFFECTS OF DRIVE STRENGTH AND CHEMICAL BLOCKING OF AUTONOMIC IMPULSES UPON MAZE LEARNING

(Publication No. 15,179)

Jack Arbit, Ph.D.
University of Illinois, 1955

A review of the literature on the physiological effects of two drugs (tetraethylammonium and hexamethonium) whose major effect is a block of impulses at the autonomic ganglia is presented. The application of these drugs to psychological research in the area of learning theory is discussed. A study is reported which attempts (1) to obtain information pertaining to the effect of autonomic blockade upon the learning of a habit dependent upon the discrimination and response to a series of sensory stimuli; (2) to introduce and obtain information pertaining to a new technique for the

replication of psychological studies upon the effect of autonomic blockade; and (3) to investigate the effect of variations in the degree of primary drive in relation to autonomic blockade and learning. It was found that impaired functioning of the autonomic nervous system did not effect the learning of the 14 choice-point maze used in this study. This finding was discussed in terms of previous research in this area which found significant effects attributable to autonomic blockade and several possible explanations for this difference were noted. Relearning measures show an interaction between drive strength and autonomic nervous system functioning such that high drive during learning produced more efficient relearning when the learning occurred under conditions of autonomic blockade. This finding was discussed in terms of the integrative quality of various degrees of autonomic activity. No significant differences were noted in the effects of tetraethylammonium and hexamethonium. In the light of these findings several suggestions were made for further research which would illuminate the role of the autonomic nervous system in learning.

93 pages. \$1.16. Mic 56-611

AN EXPERIMENTAL STUDY OF DEPTH PERCEPTION FROM THE VIEWPOINT OF THE SENSORY- TONIC FIELD THEORY OF PERCEPTION

(Publication No. 13,014)

Alvin George Goldstein, Ph.D.
Clark University, 1955

A series of experiments was carried out to investigate certain problems of depth perception from the viewpoint of an organismic theory, viz., the sensory-tonic field theory of perception.

The first experiment was concerned with the effect of organismic changes due to inspection of tilted visual objects on the physical position of the kinesthetically measured apparent frontoparallel plane. It was expected that organismic adaptation to a mirror field tilted in depth would be manifested by relative shifts of the physical position of the kinesthetic apparent frontoparallel plane in the direction of the tilt ("toward" and "away") of the inspected visual field. This was tested by having 24 subjects tactually-kinesthetically adjust to verticality an unseen rod inclined in depth after one minute inspection. Three positions of a mirror field were used: mirror tilted away from S, mirror erect, and mirror tilted toward S. In accordance with expectation, the physical position of the apparent frontoparallel plane was shifted in the direction of the tilt of the mirror field.

The second experiment was derived from the assumption that asymmetrical object stimulation induces a change in organismic state so that a more symmetrical relation obtains between a stimulus object and the organism (symmetrization). Accordingly, it was expected that if a test figure is asymmetrically placed with reference to an objective frontoparallel plane, then the physical position of the apparent frontoparallel plane will be rotated around a vertical axis toward the center of the figure, i.e., the figure will be perceived as being in a more symmetrical position with reference to the objective frontoparallel plane. Using

24 subjects this hypothesis was tested as follows. An indicator (in the form of a small white sphere) and a test figure, laterally adjacent to one another, were suspended in space at a distance of 7 feet in front of S. The test figure a 3 inch square, was always rotated 17 degrees from the line of sight around a vertical axis so that it extended in depth, i.e., one vertical edge (near reference edge) was closer to S than the other vertical edge (far reference edge). The first test square extended asymmetrically in depth from the reference edge to a point further away from S; the second also extended asymmetrically in depth from the reference edge but in the opposite direction, i.e., to a point closer to S. In addition a control test figure was used. The task for S was to adjust the small indicator toward and away from himself until it appeared to be frontoparallel with the reference edge. As expected, under asymmetrical object stimulation in depth, the apparent frontoparallel plane did not coincide with the objective frontoparallel plane but rather was rotated in the direction to which the figure extended from the reference edge.

The third experiment had its origin in the assumption that extraneous stimulation from a source other than the object attended to - will change the organismic state and in turn affect depth perception in a predictable manner. It was expected that under forward sagittal acceleration the physical position of the apparent fixation plane will be displaced away from the observer, or stated in other terms, an object that remains at a physically fixed distance will appear to move closer to the observer; opposite effects are expected under sagittal acceleration in the backward direction. Thirty-three observers reported on the relative distance of a fixed object while being rapidly accelerated in an automobile in the direction of their sagittal axes. When the direction of the induced intraorganismic counteractive force is analyzed, the results are in agreement with the hypothesis and with previous studies involving extraneous stimuli: the object appeared closer to the observer under forward acceleration and further away during backward acceleration.

93 pages. \$1.16. Mic 56-612

DELAYED LOSS OF FUNCTION DUE TO BRAIN LESION

(Publication No. 15,217)

Austin Claud Herschberger, Ph.D.
University of Illinois, 1955

The purpose of this investigation was to study the cycle of behavioral events immediately following cortical injury. Two general hypotheses have been advanced regarding the nature of underlying cortical reactions to account for deficits in performance after cortical insult. One is that after cortical injury, either by trauma or by operation, there is a sudden shock-like effect which involves much more tissue than that immediately disturbed by the insult. The other is that after cortical insult, there is a toxic condition which slowly spreads to surrounding tissue and results in the delayed appearance of behavioral deficits.

Using rats as subjects, two experiments were conducted to investigate these hypotheses. The first, employing a 14 unit multiple T maze for learning observed three different delay periods after operative removal of a small portion of

the cortex. The delay periods were eight hours, three weeks and six weeks. The results, although not quite meeting the requirement for .05 level of significance, were strongly suggestive that the second hypothesis was more characteristic of the sequence of events following cortical insult.

Since maze learning itself requires at least a week, it was argued that, could a response be found that was difficult, yet required a much shorter period of time to acquire, the differences suggested in the first experiment could be more precisely delimited. Exploratory studies revealed that the response of jumping over a barrier at the onset of a blinking light to avoid electric shock was fairly difficult and as many as 270 trials could be administered within a period of four hours after an operation.

Accordingly, a second experiment was conducted using five different delay periods between operation and testing: one hour, one day, one week, three weeks and six weeks. Both the hypothesis of a sudden shock-like effect and that of a slower spreading effect were confirmed. The one-hour group was quite inferior to normals or groups with one day delay. The three-week delay group was significantly inferior in learning to either the one-day group or the six-week group.

The results of the studies were related to theoretical models which have recently been developed as the result of current research mainly concentrated on the non-specific diffuse cortical projection system. The implications of such events occurring after cortical insult were also discussed in relation to the problem of establishing the locus of a particular function in neural tissue through ablative procedures.

87 pages. \$1.09. Mic 56-613

ANXIETY AS A MEDIATOR OF SECONDARY STIMULUS GENERALIZATION

(Publication No. 15,517)

Lloyd Lewis Lovell, Ph.D.
Cornell University, 1955

This study investigates the possibility that secondary stimulus generalization can be mediated by anxiety. Specifically, it is hypothesized that a response learned to anxiety aroused by one noxious stimulus will be elicited by a stimulus which, through association with a different noxious situation, has come to evoke anxiety.

Male undergraduate college students served as paid subjects for the study. All of them were administered a modified version of the Taylor Scale of Manifest Anxiety. Ten Experimental subjects then underwent the following procedure:

Step 1. A buzzer tone and a painful electric shock served as conditioned and unconditioned stimuli. Subjects learned that they could terminate the buzzer tone and avoid the shock by actuating a footswitch - the "footswitch response."

Step 2. In a different building, tape recorders and earphones were used to produce delayed side-tone, resulting in artificial stammer and other speech disturbance, with consequent affective responses. The momentary dimming of a light and the delayed side-tone were paired in a

conditioning procedure while subjects were reading difficult factual material aloud under motivating instructions.

Step 3. Subjects were returned to the "avoidance apparatus" for crucial trials. The number of footswitch responses to ten dimmings of a light was recorded.

Ten subjects in Control I followed an identical procedure except that the dimming of the light was not followed by delayed side-tone in step 2. Ten other subjects of Control II followed a regimen similar to that of the Experimentals except that the buzzer tone was never followed by shock in step 1. During steps 1 and 3, all subjects were required to count the number of zeroes appearing in each of a series of 10-digit random numbers presented tachistoscope-fashion.

Comparison of crucial-trial performances of the three groups reveals that four of the Experimentals, one Control I subject, and no Control II subject performed the footswitch response to one or more presentations of the dimming light. The difference between Experimental and Control I would occur by chance about fifteen times in one hundred. In addition two other Experimental subjects gave subjective evidence that secondary stimulus generalization did occur but that other, competing responses inhibited performance of the footswitch response. If their behavior is accepted as evidence that the generalization did occur, the difference between Experimental and Control I is significant beyond the five percent confidence level.

As was predicted, correlations between Taylor scores and improvement in counting accuracy suggest that anxiety level remained constant from steps 1 to 3 for Experimentals, decreased for Control I, and increased for Control II.

It is concluded that anxiety is capable of mediating secondary stimulus generalization, and that the motivating characteristics of anxiety and the reinforcing characteristics of anxiety-reduction are similar, whether anxiety is aroused by physiological or psychological threat.

81 pages. \$1.01. Mic 56-614

RELATIVE ACCEPTABILITY OF SUCROSE AND GLUCOSE SOLUTIONS TO THE WHITE RAT

(Publication No. 15,269)

Emir Hamvasy Shuford, Jr., Ph.D.
University of Illinois, 1955

Three experiments were performed in order to determine the relative acceptability of sucrose and glucose solutions and to study the operation of a taste factor which facilitates drinking and a post-ingestion factor which inhibits drinking.

Exp. I. Six groups of rats were trained to discriminate between a white cup and a black cup on the basis of the concentration of the solution contained in the cup. Sucrose solutions of 5%, 15%, and 45% concentrations were paired with a 15% glucose solution. The rats learned to select the 15% and 45% sucrose solutions instead of the 15% glucose solution and to select the 15% glucose solution instead of the 5% sucrose solution. The color (black or white) of the cup containing a solution was found to be an important factor determining rate of learning. The Bush and Mosteller model for two subject-controlled events was employed in the analysis of the data. The results indicate that the values of the

parameters α_1 and α_2 depend upon the particular pairing of the solutions. The conclusion was drawn that the factor determining rate of learning was the difference in sweetness between the pair of solutions.

Exp. II. A relative intake method using paired stimuli was used to determine the concentration of sucrose required to match a given concentration of glucose in acceptability. A curve giving equally acceptable solutions of sucrose and glucose was plotted on the basis of three experimentally derived points. Comparisons were made with isosweetness data from humans and rats. It was concluded that the acceptability of sucrose and glucose solutions is determined primarily by the intensity of stimulation of the "sweet" receptors.

Exp. III. Intake curves were obtained by the single stimulus method for solutions of sucrose and glucose that were of equal sweetness (as determined in Exp. II), but of different osmotic pressure. The following conclusions were drawn:

- 1) A taste factor, related to the sweetness of the solution, operates to determine the rate of drinking during the early part of the drinking period.
- 2) A post-ingestion factor, related to the osmotic pressure of the solution, comes into operation, after a variable period of time and after a given amount of solution has been ingested, to slow the rate of drinking.
- 3) The higher the osmotic pressure of the solution, the earlier the post-ingestion factor begins to inhibit drinking.
- 4) Total intake for a twenty minute period is a linear function of osmotic pressure for hypertonic solutions of sucrose and glucose.

63 pages. \$1.00. Mic 56-615

DISCRIMINATION LEARNING AS A FUNCTION OF DRIVE LEVEL AND CUE SIMILARITY

(Publication No. 15,505)

Alfred Steinschneider, Ph.D.
Cornell University, 1955

The present experiment was conducted with the following purposes in mind: 1) To determine the applicability of the Yerkes-Dodson Law to a positive drive — hours food deprivation, 2) To determine the effect of drive level and cue similarity on VTE's, and 3) To determine the effect of drive level and cue similarity on the development of the discrimination habit.

Two groups of animals were trained on a 4-unit elevated discrimination apparatus in which the brighter of two stimulus cards was positive. One of these groups was required to learn a discrimination in which the similarity of the two stimuli was less than that presented to the other major group — easy discrimination group and difficult discrimination group. Each discrimination group was sub-divided into four deprivation groups representing 12, 24, 36, and 48 hours of food deprivation. All animals were trained until they reached a criterion of 18 correct responses out of a possible 20 on a single day.

Animals learning the easy discrimination problem made fewer errors and required fewer responses than did animals learning the difficult discrimination problem.

No interaction was obtained between drive level and discrimination difficulty as reflected in the total number of responses and errors that were made prior to reaching the criterion. These results could not be taken as support for the applicability of the Yerkes-Dodson Law to positive drives.

The results did suggest that increases in hours deprivation produced an increase in the number of responses and errors made prior to the criterion. This was consistent with the hypothesis that drive narrows the cognitive map.

The average number of VTE's per response increased with each successive unit of the learning period, tending toward an asymptotic value. This was obtained for all drive groups but the 36-hour deprivation group. For the latter group, VTE's decreased with successive learning units, reaching a minimum, and then tending to increase.

A significant interaction was also obtained between the discrimination task and drive level as reflected in the number of VTE's per response. Although the drive level had very little, if any, effect on the number of VTE's per response for those animals learning the difficult discrimination, a definite relationship was obtained for the easy discrimination. For this latter task, an increase in drive level resulted, in general, in a decrease in the number of VTE's per response.

Hours deprivation and discrimination difficulty had no effect on the shape of the learning curve. The former results are inconsistent with Hullian theory.

A significant interaction was obtained between discrimination difficulty and drive level as they influenced the mean percentage of correct responses. For the easy discrimination, the 24- and 36-hour deprivation groups made the smallest percentage of correct responses, whereas for the difficult discrimination these same deprivation groups made the largest percentage of correct responses.

107 pages. \$1.34. Mic 56-616

GASTROINTESTINAL TRANSPORT AS A FACTOR IN DRINKING RATE OF WATER DEPRIVED RATS

(Publication No. 15,286)

Henry H. Weiss, Ph.D.
University of Illinois, 1955

The purpose of the study was to determine the course of ingested water as it moves through the gastrointestinal tract of dehydrated rats and to obtain a picture of the filling and emptying of the stomach and intestine as drinking ensues and terminates. Rate of water intake and absorption from the small intestine were measured in two groups of animals that were on 23 1/2 or 47 1/2 hours water deprivation. The groups were further subdivided so that animals would drink either for 4, 8, 12, 16, 20 or 30 minutes from a eudiometer tube before being killed. At the end of the pre-determined drinking interval the rat was killed by etherization and the weight of the water in its gastrointestinal tract was obtained to determine the amount of ingested water that had been absorbed. A control group of animals which were not allowed to drink was used to estimate the tissue water of the experimental animals. It was seen that 24 hour animals drank more rapidly during the early part of the drinking period but eventually the 48 hour animals ingested more water by drinking longer. Twenty-four-hour animals pause in their drinking after eleven minutes after consuming 87 per cent of their intake whereas 48-hour deprived animals pause after 16 minutes during which time they drink 82 per cent of their total intake. Once the intestine is fully distended absorption proceeds at a constant rate for both groups of animals. The salient finding of the study is that drinking is inhibited when the greater percentage of ingested water has yet to be transported to the dehydrated cells, i.e., termination of drive, as inferred from cessation of drinking, precedes removal of deficit.

69 pages. \$1.00. Mic 56-617

RELIGION

A STUDY OF THE INTERPRETATION OF THE NEW TESTAMENT IN NEW ENGLAND UNITARIANISM

(Publication No. 15,623)

Eugene Robert Chable, Ph.D.
Columbia University, 1955

There were many historical antecedents to American Unitarianism. These begin with the Arian controversy and continue through the Reformation period. Servetus, Socinus, Ochino, Blandrata, Francis David, and others were prominent in various movements developing in Transylvania, Italy, Switzerland, Holland, Germany, France, and elsewhere. The development of Unitarianism among the Dissenters and others in England more directly affected the subsequent growth in America, where the writings of Lindsey, Priestley, Belsham, and others flourished.

Unitarianism in America began in the New England Congregational churches where, in one sense, it was an outgrowth of the rationalism of the Enlightenment, and, in another sense, represents a protest against the emotional excesses of the Great Awakening.

The first Biblical critic in America of any consequence was a Unitarian, Joseph Stevens Buckminster, appointed in 1811 as Dexter Lecturer in Biblical Criticism at Harvard College. The receptivity of Unitarians to liberal thought and their emphasis on Reason made them welcome the results of Biblical criticism more than their orthodox contemporaries, from which they separated increasingly during the first quarter of the nineteenth century.

William Ellery Channing, the acknowledged leader of this movement of thought in America, in 1819 delivered his famous Baltimore Sermon. This was a classic and vivid statement of the role of Reason in Biblical interpretation. Though more Arian than Unitarian, Channing in his writing

and sermons gave impetus to the movement and represents a distinct epoch in American Unitarian thought.

Andrews Norton, Buckminster's successor at Harvard, was Unitarianism's greatest Biblical critic. In comparison with others, Norton was a conservative Unitarian in both theology and Biblical interpretation. Buckminster introduced the works of German Biblical scholarship in America, and Norton was thoroughly familiar with the writings of Strauss, Paulus, Eichhorn, Michaelis, De Wette, and others. Norton reacted strongly against the rationalism of the German critics, calling it "infidelity". Norton's primary purpose was to support his belief in the genuineness of the Gospels.

Unitarian writers published a great number of tracts and pamphlets in the first half of the nineteenth century. Many of these represent attempts to support Unitarian theological views by a strong appeal to the New Testament. The use of reason is prominent in the Biblical interpretations given in this literature. These tracts and pamphlets costing but a few cents, were widely circulated and very influential.

In 1838 Ralph Waldo Emerson in his Divinity School Address announced the gospel of transcendentalism, with its reliance on man's intuition and moral sentiment for the validity of religious truth. Norton attacked Emerson's views as The Latest Form of Infidelity.

Emerson and the transcendentalists profoundly affected Theodore Parker. Parker possessed a brilliant mind influenced by the Enlightenment in general and by the rationalism of the German Biblical critics in particular. He popularized the results of German Biblical scholarship in both his writings and sermons. Parker's major contribution was a critically-annotated translation of De Wette's Einleitung.

Parker's influence on the subsequent history of Unitarianism cannot be over-estimated. His radical criticism of the Bible evoked protests against its methods and results, from William Henry Furness, James Freeman Clarke, and others. These could not, however, stem the tide of Parker's influence. In the latter part of the nineteenth century many radical Unitarians went beyond even Parker into "Free Religion", in which they were no longer concerned to be identified as "Christian". Radical Unitarianism progressively lost interest in Biblical studies and turned increasingly to questions of social concern. In the twentieth century many Unitarians went beyond "Modernism" to Humanism. Unitarians had been pioneers in introducing Biblical criticism in America; they were also the first group to abandon it to others.

386 pages. \$4.83. Mic 56-618

THE REACTIONS OF PARENTS TO A JEWISH ALL-DAY SCHOOL

(Publication No. 15,115)

Louis Nulman, Ph.D.
University of Pittsburgh, 1955

The purpose of the study was (1) to discover some of the basic factors which influenced parents to enroll their children in the Hillel Academy of Pittsburgh, a Jewish all-day school; and (2) to trace some changes in the attitudes and behavior of these parents which were effected by the

participation of their children in the program of the school. By using a pretested interview schedule, the investigator interviewed personally 192 of the 201 parents (comprising 104 families) whose children attended Hillel Academy during the academic year of 1954-1955.

There was a wide range in the economic status of the families. Most of them lived in areas of heavy Jewish population. More than half of the parents were native-born and practically all of the foreign-born were of Eastern European origin. Most parents of the native-born parents were also from Eastern Europe. About half of the foreign-born parents have arrived in this country since World War II. Very few of the parents had ever attended an all-day school. Fifty-seven families were affiliated with Orthodox congregations, one with a Conservative congregation, and 46 were unaffiliated. Only 35 of the homes were rated as "observant" from the Orthodox point of view, though in most of the homes some degree of ritual was observed. Of the parents who have formal connections with organized groups, only a very few belonged to non-Jewish organizations, the majority being affiliated with B'nai B'rith, Haddassah, Hapoel Hamizrachi, Mizrachi, and the Zionist Organization of America. In the 72 homes where English was the predominant language, Yiddish was spoken only in a few homes and on rare occasions. Many parents did not have a complete understanding of the philosophy and program of the school. They were also confused as to their own positions regarding Jewish belief and practice.

The parents showed a strong approval of Hillel Academy because it provided their children with a "complete" education. It is evident that the school contributed to the intensification of parents' interests in Judaism, some reviving neglected observances and others taking on new ones.

Though most parents seemed to have a high regard for the public school, generally speaking, they decided to enroll their children because they considered it otherwise impossible to give their children a good Jewish education. There was no central tendency in the factors influencing parents to enroll their children. The process of choosing Hillel Academy involved direct and indirect influences on parents, parents' perceptions, reactions, attitudes, predispositions, and conceived goals for Jewish education.

There were at least five distinguishable types of parents included in the study:

1. Parents who are observant and deeply interested in things Jewish enroll their children in the school because they are certain that its program is in basic agreement with their own way of life.

2. Parents who know little or nothing about Judaism, but feel a personal "lack" or "yearning", have taken the school seriously and have encouraged their children to accept its teachings. In turn, they themselves have become more closely tied to Jewish observance.

3. Parents who are primarily interested in the cultural aspect of Judaism are pleased with intensive Jewish education but have not fully accepted Hillel Academy's emphasis on the teaching of ritual observance.

4. Parents from Eastern Europe, who have had ample opportunity to see and learn Jewish life in its richest form, have drifted away from the Jewish life they once knew. These find that through their children who attend the school they are reminded of their early experiences. They are pleased that their children halt their declining interest and observance of Judaism.

5. Parents who do not usually exhibit strong Jewish identification and activity, yet have chosen to send their children to the school for the same reasons as parents in the other groups. These seem to be completely unaffected by the school. Although they do not object to the school's teachings, they endeavor to transmit to their children the idea that the home and school operate in two unrelated spheres. 146 pages. \$1.83. Mic 56-619

IMPLICATIONS OF THE DOCTRINE OF MAN FOR CHRISTIAN EDUCATION. AN ANALYSIS OF THREE CHRISTIAN DOCTRINES OF MAN; A STUDY OF THEIR IMPLICATIONS FOR CHRISTIAN EDUCATION; AN ANALYSIS AND EVALUATION OF THE USE OF THESE DOCTRINES IN CHRISTIAN EDUCATION TODAY.

(Publication No. 15,576)

Donald Beeler Reitz, Ph.D.
New York University, 1955

Because the religious education movement has developed principally during the past century and has been oriented to an educational background rather than to a theological one, the historic theological positions of the Church have not always been the basis upon which the procedures and philosophy of religious education have been built.

The Problem

To investigate the possibility of cleavage between these two approaches in the area of the Christian doctrine of man becomes the focus of the present study. The problem is to compare the implications for religious education of three widely-held Christian doctrines of man, and to show how these implications agree with and differ from the position of the Division of Christian Education of the National Council of the Churches of Christ in the United States of America, as expressed in its publication Christian Education Today, with a view to discovering what Christian doctrine of man, if any, is dominant in this generally accepted philosophy of Protestant religious education. The problem assumes importance in a period of changing emphases in theology because what is believed about the nature and destiny of man helps to determine the objectives of Christian education.

Methods of Investigation

The first step in the investigation was an historical exposition of the three doctrines of man as they are set forth

in three theological traditions; Augustinianism, Thomism and "reconstructed" Liberal. The first tradition includes St. Augustine, the most influential of the "Early Fathers," the Reformers Luther and Calvin, and represents a large area of contemporary Protestantism. Thomism is representative of the Roman Catholic Church. Thomas Aquinas, its founder, harmonized Christian doctrine with Aristotelian learning and has become the great teacher of his church. The "reconstructed" Liberal tradition has been an approach made by many contemporary American theologians. It recognizes the weaknesses of Liberalism, but seeks to underline the validity of the liberal approach to theological problems.

The second step in the study was a comparison and analysis of the doctrines for agreements, differences and implications for religious education. To make significant comparisons a series of ten theological categories was employed: the origin of man, the constitutional nature of man, man as the Image of God, the origin of sin, the essential character of sin, the transmission of sin, sin in the life of the human race, the punishment of sin, the covenant of redemption, the covenant of grace.

The third step was an evaluation of Christian Education Today, with a view to discovering which doctrine of man, if any, it uses. The same series of theological categories was used to provide a framework for the evaluation.

Significant Findings

The doctrine of man set forth by the Augustinian tradition is generally pessimistic; man is represented as having little hope of achieving his own salvation. By way of contrast, the Thomist doctrine of man is generally optimistic, giving man a responsible share in his redemption because of his reason. In a mediating position is the "reconstructed" Liberal tradition, which seeks appreciative evaluation of historic doctrinal positions and at the same time recognizes the validity of empirical studies concerning man.

In its doctrine of man, Christian Education Today reflects very little of the Augustinian tradition, some of the Thomist tradition, and to a larger degree the "reconstructed" Liberal tradition. There is, however, the implication that Christian Education Today is not adequately grounded upon a Christian doctrine of man. Since a doctrine of man is an important aspect of each of the traditions a philosophy of religious education reflecting the concerns of the traditions should be based upon a fully articulated doctrine of man. 362 pages. \$4.53. Mic 56-620

SOCIAL PSYCHOLOGY

A STUDY OF WORK EFFICIENCY OF BLIND AND SIGHTED WORKERS IN INDUSTRY

(Publication No. 15,570)

Douglas Cortland Mac Farland, Ph.D.
New York University, 1955

This research is a scientific appraisal of the relative work efficiency of blind industrial workers. Many studies have been conducted using blind employees as comparative subjects, but in every instance the sampling included cases with more vision than the legal limitation of blindness or included workers in sheltered workshops. The need arose from an earnest desire on the part of those engaged in vocational rehabilitation to present the potential employer with factual data concerning the performance he could reasonably expect from a blind employee.

The criteria in choosing blind subjects were that they have no more than light projection in the better eye and that they have at least one year's experience on the job. The thirty-eight blind subjects participating in the study encompassed all the available blind industrial workers in the states of Connecticut, New Jersey, New York, Maryland, and Pennsylvania who met the criteria. Public and private agencies for the blind provided case material for locating eligible subjects. The workers and their employers were concurrently contacted to gain permission for the study. The thirty-eight sighted subjects were those persons who were employed at the same job operation as the blind subjects, in the same plant and under the same supervision, for at least one year. These people were chosen by their immediate supervisors, and their participation depended on their willingness to volunteer for the study.

Work efficiency was defined for the purposes of this study as being composed of annual earnings, production (quality and quantity), absenteeism, tardiness, and safety on the job, and data for all these components were obtained from the companies' personnel records. In addition, the investigator obtained intelligence quotients for all subjects by the administration of the Wechsler Bellevue Intelligence Scale (verbal form), and hand coordination and fine finger dexterity ratings were obtained by the administration of the Pennsylvania Bi-Manual Worksample and the Minnesota Rate of Manipulation tests. Personal information was obtained from each subject through a tape-recorded case history interview in order to give an integrated picture of the subjects in the study.

All the information for both groups of workers is presented in tabular form so that the similarities and differences are readily apparent. In the scores on the intelligence test, the mean for the sighted workers was 96.42 and for the blind was 107.76, with a τ of 4.25. This might indicate that a higher degree of intelligence was required for a blind person to succeed on an industrial job, but the number of subjects was too small to draw a definite conclusion. The results of the motor skills tests showed

significant differences in all areas but the displacing part of the Minnesota Rate of Manipulation; these findings, however, are no different than those recorded by others using the same tests and testing procedures, and they had no discernible effect on the elements of work efficiency.

The six factors used to define work efficiency in the study were analyzed and no significant differences were found except with respect to tardiness, where a τ of 4.418 in favor of the blind was obtained. The number of industrial injuries was small, but their incidence clearly indicated that, although the blind workers had more minor accidents, only one was severe enough to cause any time lost from work. The absence for this one worker was 27.2 per cent of the total for industrial injuries in the comparable group of sighted workers.

A composite picture of the study, especially those factors relating to work efficiency, clearly indicates that the blind industrial worker is comparable to the sighted worker and that in the matter of tardiness his record is significantly better. The study shows a need for more adequate testing instruments in the motor skills area and suggests a study of motivation to determine the factors that contribute to the success of a blind industrial worker.

87 pages. \$1.09. Mic 56-621

THE INFLUENCE OF RECREATION PARTICIPATION UPON THE BEHAVIOR OF SCHIZOPHRENIC PATIENTS: A STUDY OF RECREATION ACTIVITY PRESCRIPTION, BASED UPON A KNOWLEDGE OF THE PATIENTS' PRE-MORBID PARTICIPATION EXPERIENCES

(Publication No. 15,550)

Martin William Meyer, Ed.D.
New York University, 1955

Chairman: Professor Milton A. Gabrielsen

The primary purpose of this investigation is to determine whether prescribed active participation in recreation can favorably influence the behavior of long term, chronic, inactive schizophrenic patients. A secondary purpose is to determine whether prescription of activities based on pre-morbid participation experience is more beneficial than prescription of activities based on no pre-morbid participation experience.

The significance of this study lies in its contribution towards clarifying the role that active participation in recreation activities can play in the care and treatment of chronic schizophrenic patients. It also can help justify the expenditure of millions of dollars by the federal government, states and local communities, for recreation programs in their mental hospitals.

The experimental procedure began by obtaining the

pre-morbid participation experiences of the patients through a mailed questionnaire to the next of kin. Additional information was secured from the social service and clinical records. Each of the patients was rated by the Montrose Behavior Rating Scale and an individual profile established. From these profiles, sixty-six perfect sets of "threes" were matched, for the formation of two experimental groups and a control group, of twenty patients each, and a reserve of six sets.

The two experimental groups and the control group lived together for the duration of the experimental period, and followed identical routines, except for the single variable of active participation in recreation activity. The first experimental group was given a program of three active participation recreation activities, selected from the patients' pre-morbid recreation participation histories, from 1:00 to 4:00 P.M. daily, for a period of six consecutive months. The second experimental group was given a program of three active participation recreation activities, not included in the patients' pre-morbid participation histories, during the same hours and for the same length of time. The control group, in lieu of recreation, remained on the ward dayroom. At the mid-point and conclusion of the experimental period, the Montrose Behavior Rating Scale was again administered.

A t-test for the determination of the significance of the difference between the means of the first and second tests, and first and third tests, for all three groups, resulted in t-values which were significant at the one per cent level of confidence, indicating that a significant change in behavior took place.

An analysis of variance between the three groups at the conclusion of three and six months, resulted in F-values, for the total test scores, of 22.4 and 28.5, which are significant at the one per cent level of confidence, indicating a significant change in behavior between the three groups.

A t-test for the determination of the significance of the difference between the means of the two experimental groups after three months, resulted in a t-value of 2.05, which is significant at the five per cent level of confidence. However, at the end of six months, the t-value was 1.2, indicating no significant change in behavior. The t-values between both experimental groups and the control group, after three and six months, were significant at the one per cent level of confidence.

On the basis of the data presented in this study, the following conclusions were reached:

Active participation in recreation activities by schizophrenic patients will result in a favorable change in their behavior.

Schizophrenic patients not given recreation activities will have an unfavorable change in their behavior.

Active participation in recreation activities based on pre-morbid participation experience will be more beneficial than active participation based on no pre-morbid participation experience, after three months, but not after six months.

164 pages. \$2.05. Mic 56-622

AN ANALYSIS OF THE CONTENT OF INTERPERSONAL PERCEPTION

(Publication No. 15,537)

Lee Roy Wolin, Ph.D.
Cornell University, 1955

This study represents an exploratory investigation of the different ways in which individuals perceive other persons in a social situation. Fifty undergraduate women from Cornell University were introduced into what was ostensibly a laboratory experiment in visual perception. The situation used was calculated to arouse controversy among the participants as the basis for social interaction. In each experimental session seven women served as subjects, six of these being stooges (Cooperating S's) placed there by the experimenters. Following the 'perception' experiment, the experimenter left the room and a prearranged 'spontaneous discussion of the experiment began. During this discussion each of the Cooperating subjects played a rehearsed role which was individualized so as to differentiate it from the other roles.

Following the discussion the experimental subject was given a battery of tasks, two of which are relevant here. First, she was requested to describe each of the other participants in the experiment in as "life-like and accurate" a way as she was able (spontaneous description). Following this she was given a list of adjectives and again asked to describe each person by checking all those adjectives which were applicable to the individual. The check list was constructed to cover five areas of information (content categories) about other persons — clothing, physical appearance, activity, experiential (feelings and emotions), and characterological (personality and temperament). The spontaneous descriptions were later analyzed in terms of these same categories plus an additional category called "background data." The items on the check list were all scored for veridicality by comparison with criterion data about each Cooperating subject.

As predicted, analysis of the quantitative scores (approach scores) based on differential usage of the several content categories revealed significant differences among subjects in their preference for different types of content. These differences took the form of a split between physical characteristics (clothing and appearance) and psychological characteristics (experiential and characterological), some persons emphasizing one and some the other. The category of activity which included general bodily activity and speech showed high correlations with both the above gross divisions.

Also as predicted, individual differences in descriptive approach on the check list, while significant, were much less marked than those from the spontaneous descriptions.

The subjects also differed in ability to describe other people correctly. These differences in skill were found in each category as well as for all categories combined. The data suggest that with reference to the content areas studied here, there exist both specific skills and a general skill for veridical perception of the characteristics of other people.

A distinct but not statistically significant relationship was noted between preference for a given category and sensitivity to that category. More striking was the relationship between approach and general sensitivity to other people. Persons who described others primarily in terms of psychological characteristics were more sensitive to all categories than persons who described others primarily in

terms of physical characteristics. This relationship was statistically significant for the characterological approach. It appears that persons who are set to perceive physical characteristics of others are sensitive only to these characteristics. In contrast, persons who are set to perceive the essentially human, psychological characteristics of others tend to be sensitive to all aspects of other people, including their physical characteristics.

The above results suggest that individual differences in the content of social perception, regardless of veridicality, constitute a useful variable for the study of questions such as the relationship of personality and situational factors to social perception, and the development of social perception. 110 pages. \$1.38. Mic 56-623

SOCIOLOGY

SOCIOLOGY, GENERAL

CRIMINAL HOMICIDE WITH SPECIAL REFERENCE
TO PHILADELPHIA, 1948-1952

(Publication No. 13,445)

Marvin Eugene Wolfgang, Ph.D.
University of Pennsylvania, 1955

Supervisor: Dr. Thorsten Sellin

This study, based on police statistics, analyzes 588 criminal homicides that occurred in Philadelphia, Pennsylvania, 1948-1952. Variables among 588 victims and 621 offenders were tested primarily by chi-square. A review of previous studies on criminal homicide provides perspective to local patterns and emphasizes the invalidity of inferring characteristics about offenders from mortality statistics, or about victims from criminal statistics.

Analysis is made of both victims and offenders as separate units and as mutually interacting participants. Although homicide is largely an unplanned act, empirical uniformities of specific social phenomena are discernible. Significant associations exist between criminal homicide, Negroes and males. Offenders aged 20-24 have highest rates. Significantly the lowest five-year age-specific rate for Negroes is higher than the highest rate for whites. Offenders are generally younger than victims.

Methods of inflicting death are related to race and sex of victims and offenders. Negro males usually stab, white males beat their victims; females stab with butcher knives but are beaten to death.

Although there is no association between months or seasons and criminal homicide, weekends — particularly Saturday — are positively related to homicide, as are the hours between 8:00 p.m. and 2:00 a.m. Improved communication with police, more rapid transportation to hospitals, and advanced medical technology contribute to decreasing homicide rates.

Specific place of homicide is related to the race and sex of victim and offender. Men slay and are slain usually in public streets; women generally kill in kitchens but are killed in bedrooms.

In two-thirds of the cases victims or offenders were drinking prior to the slaying. Associated with alcohol are: Negroes; Negro stabbings; white beatings; weekends; brutal killings. Excessively violent slayings most likely involve a husband who brutally beats his wife.

Criminal homicides mostly result from vaguely defined altercations, domestic quarrels, jealousy, revenge, and are more personalized when directed against or by women. More whites than Negroes are strangers to their assailants; more Negroes are felony-murderers. Four-tenths of females compared to one-tenth of males killed are slain by their mates. More males than females in spouse slayings are convicted and commit suicide after homicide.

Ninety-four per cent of homicides are intra-racial, and 64 per cent involve persons of the same sex. Negro offenders cross race lines six times more frequently than whites.

Thirty-two cases involve 57 offenders and 6 victims who committed felonies during homicides.

Victim-precipitated homicides refer to cases in which victims are direct precipitators who first use physical force in the homicide drama. Variables associated with 150 such homicides include: Negroes, male victims, female offenders, stabbings, mate slayings involving husbands as victims, alcohol in victims, victims with previous arrest records, altercations, domestic quarrels, inter-racial slayings.

Four per cent of offenders commit suicide, half of whom are white. In homicide-suicides the ratio of different-sex to same-sex of victims and offenders is 9 to 1 while all homicides are 1 to 1.8. Compared with solved cases the 38 unsolved have higher proportions of: white victims aged 65 years or over, strangers robbed, beaten in streets, killed during weekends.

Two-thirds of offenders are arrested the same day of the crime; half face trial within 6 months. Two-thirds of those apprehended and three-fourths of those tried are convicted. A significantly higher proportion of Negroes than whites are convicted. Of 387 sentenced offenders, first degree murder constitutes 20 per cent, second degree murder 29 per cent, voluntary manslaughter 36 per cent, involuntary manslaughter 15 per cent. Only 3 per cent are declared insane, a proportion similar throughout the country, but much smaller than the 30 per cent or more reported insane in England. 393 pages. \$4.91. Mic 56-624

SOCIOLOGY, PUBLIC WELFARE

THE FUNCTION OF SOCIAL PROCESS IN
RECRUITING, TRAINING AND UPGRADING
VOLUNTEER INDIGENOUS LEADERSHIP

(Publication No. 13,643)

Floydell Anderson, Ed.D.
New York University, 1955

Chairman: Professor Dan W. Dodson

The purpose of this study was to document the operation of a community workshop program which used social or group process for the recruitment, training and upgrading of volunteer indigenous leadership. Twenty church, civic and social organizations principally concerned with Negro welfare were brought together under the auspices of the Nepperhan Community Center of Yonkers, New York for the purpose of discussing and solving common community problems. The program was conducted from June 13, 1953 through June 19, 1954 and consisted of four all-day conferences with fact-finding periods between each conference.

The experiment was conducted on the assumption that the objectives of education are found in the activities of people, and the activities of people take place in, and are conditioned by the communities in which they live. In documenting the program an attempt was made to observe how democratic group processes work on a small fundamental scale. It was assumed that a knowledge gained from such an experiment might very well provide a basis for understanding how small basic groups can be combined into larger social units without sacrificing the individual.

Data for the documentation of the workshop were collected from personal interviews, tape recordings of workshop sessions, official records of the Nepperhan Community Center, a diary of community events and the observations of qualified resource persons. These data were used in conjunction with the evaluations of the delegates, resource personnel and process observers in making supported generalizations with regards to the workshop program.

The general conclusions reached as a result of this experiment were as follows:

1. A series of workshop programs designed for recruiting, training and upgrading volunteer indigenous leadership can be an effective instrumentality in providing meaningful experiences, fostering clearer understanding of urgent community problems, encouraging teamwork and developing initiative in a given community. Achievement of these ends is not possible by simply applying a patent technique to a given type of situation, but by providing infinitely adaptable methods to infinitely varying problems.

2. The workshop, being composed entirely of representatives of Negro organizations did not readily lend itself to the development of community integration. Delegates to the workshop concerned themselves with discussions of "Negro" problems to the exclusion of exploring personal deficiencies or relating personal problems to the over-all community.

3. New volunteer leadership appeared to have emerged as a result of specific problems bearing upon the interests, abilities and experiences of given individuals.

4. Group process appeared to have been retarded in instances where resource persons and discussion leaders were not sure of the roles they were expected to play at a given workshop session.

5. The presence of "experts" or prominent personalities as resource persons tended to inhibit the expressions of individual opinion. Delegates appeared to have come to the workshop hoping that the "experts" would do something for them rather than to do something for themselves with regards to pertinent community problems.

The recommendations emerging from the workshop experience were as follows:

1. In preparing for a community workshop program the widest possible cross section of community organizations should be included on the planning level.

2. When possible, resource persons, official recorders and observers should attend planning meetings or be thoroughly briefed as to their duties before being allowed to serve at a given workshop session.

3. A continuing program of research should be conducted into the nature of the training process and the effect of this training upon the actions of volunteer indigenous leaders.

184 pages. \$2.30. Mic 56-625

SPEECH - THEATER

DEBATE IN THE 1953 MICHIGAN LEGISLATURE

(Publication No. 14,756)

Frederick George Alexander, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Henry L. Ewbank

This study examines "floor debates" in the 1952, 1953 and 1954 sessions of the Michigan legislature. Its purpose is to observe political argument on the state level and in the commonwealth of Michigan. It raises the two basic questions of how much debating accompanies the democratic process in state legislatures, and to what extent participation in this debating bears on political influence.

To establish a general frame of reference for the study, we examine: (1) the origin and rise of state governments and their receptivity to the democratic idea; (2) some of the benefits and hazards of federalism; (3) the evil reputation of state legislatures and contemporary efforts to improve them; (4) some of the legislative history of Michigan and its relationship to passing national and local events from its inception as a state up to the present.

The men and women responsible for Michigan's law-making receive substantial attention in the study. We discuss the well-known farmer-lawyer concentration in legislatures, as well as other occupations represented. The question involving influence of age and seniority is raised. We find that Michigan's urban citizens are under-represented in the legislature, and the consequent need for a more equitable distribution of seats is emphasized. We see that party strength in the Michigan legislature is directly related to this "rotten borough" system, and prompted one minority legislator to exclaim, "Michigan gives more votes to navy beans and tree stumps than it does to its citizens."

The progress of a proposed measure is traced from the drafting stage to the voting stage in the legislative process. We observe some of the strange antics of legislators in the opening and closing of a typical session. And we examine such influences on legislation as the lobbyist, the press, the governor, the gallery and the voter.

An evaluation is made of speech as a political tool, emphasizing particularly the values of discussion and debate. We underscore the maxim that democracy suffers whenever the right of free expression is abridged. Nevertheless, we find in the Michigan legislature a substantial measure of political gobbledy-gook that requires an experienced interpreter to translate what the lawmakers are really saying.

In addition to value judgments of political speaking in general, some of the characteristics of speaking by Michigan legislators are reviewed. The brevity of legislative debate is commented on. The relative absence of prepared speeches is revealed. And the widespread use of appeals to emotion is considered.

The final portion of the study is devoted to a content analysis of 351 bills and the debates that accompanied

them in the 1953 session. Both the Senate and the House are covered in the analysis. With the cooperation of state lobbyists a listing of influential and non-influential legislators was compiled, and the speech activities of these gentlemen were also analyzed. The results of the analysis are graphically portrayed in a series of plates included in the final chapter.

The conclusions indicate that debate accompanies approximately one-fourth the measures which come before a state legislature, and legislators considered influential are substantially more active in debate than are most of those considered non-influential.

209 pages. \$2.61. Mic 56-626

THE SPEAKING OF JOHN PETER ALTGELD IN THE ILLINOIS GUBERNATORIAL CAMPAIGN OF 1892

(Publication No. 15,184)

Coleman Bender, Ph.D.
University of Illinois, 1955

The 1892 gubernatorial election in Illinois was the first attempt by John Peter Altgeld to present his ideas to the people of Illinois. The purpose of this study was to determine the major rhetorical problems he faced in the campaign and to examine his methods of meeting them. We proposed to find out to whom he spoke, what he said, and the audience reaction. Finally, we attempted to state the major attributes of his speech-making.

Altgeld used three major forms of communication with the people of Illinois. His hand-shake tour, a series of informal talks, took him into all major cities and towns of the state. His interviews with the press were designed to clarify his position on issues or events and to answer those charges against himself that he felt worthy of note. His speeches were special occasion addresses and campaign talks. In the special occasion talks, Altgeld was more inclined to figurative language than in the political talks, which were primarily attacks against both state and national Republicanism.

In the formal campaign addresses, Altgeld selected issues to appeal to both the immediate and the long-range audience. His primary attack on national issues was directed to the tariff. He held the tariff responsible for trusts, monopolies, low farm prices, low wages, and the high cost of manufactured articles.

Among the state issues receiving primary attention were: the Edwards School Law, a law opposed by those who favored a private or parochial school; alleged support of the Republican party by the super "patriotic," Know-nothingism organizations such as the Patriotic Sons of America; the anti-labor record of the Republican party; and the alleged fraud and corruption in the state charitable and penal institutions.

Altgeld made his ideas clear through the use of comparison, hypothetical illustrations, use of the concrete and specific instance, and a logical or chronological structural pattern. He made his ideas credible through the use of statistics, historical illustrations, testimony, quotation, and cause-and-effect relationships and reasoning from general principles. He enhanced his ideas chiefly through the use of figurative language, rhetorical questions, climactic arrangement, axioms and epigrams. He built up his own credibility through direct and indirect reference to his own preparation and background, and by plainness of manner and speech. His delivery was characterized by an adequate though not impressive voice and by a general lack of gestures or movement on the platform. He won the favor of his audiences by his naturalness, sincerity, and earnestness.

335 pages. \$4.19. Mic 56-627

**A COMPARATIVE STUDY OF THE LINGUISTIC
FUNCTIONING OF BILINGUAL SPANISH-AMERICAN
CHILDREN AND MONOLINGUAL ANGLO-AMERICAN
CHILDREN AT THE THIRD GRADE LEVEL**

(Publication No. 15,122)

Sister Mary Arthur Carrow, Ph.D.
Northwestern University, 1955

This investigation was designed to study the linguistic functioning of two groups of third-grade children who differed with respect to the number of languages spoken, but who were otherwise similar in regard to age, socio-economic background, and intelligence. The children included in the bilingual group had been exposed to the Spanish and English languages in the home from infancy, could communicate in both languages by the age of three, and preferred the English language at the time of testing. The children included in the monolingual group had been exposed only to the English language in the home from the time of infancy and could communicate only in the English language.

The following language measures were employed to obtain information regarding the linguistic functioning of the bilingual and monolingual children:

1. The California Achievement Test, Primary, was used to measure achievement in silent reading, spelling, mechanics of English, and arithmetic reasoning.
2. The Durrell-Sullivan Reading Capacity Test, Word Meaning, was used to evaluate performance in understanding (hearing) vocabulary.
3. The Gilmore Oral Reading Test was employed to test achievement in oral reading accuracy, comprehension, and rate.
4. Fairbanks' Test of Articulation for Non-Readers was used to evaluate articulatory proficiency.
5. A three-minute sample of oral language was employed to study oral language usage as measured by the total number of words spoken, the number of different words used, clause length, degree of subordination, complexity of sentence structure, and grammatical errors.

The major findings of the investigation are summarized as follows:

1. With the 5 per cent level of confidence used as the critical level, the monolingual group was significantly

superior to the bilingual group in oral reading accuracy and comprehension, hearing vocabulary, arithmetic reasoning, mechanics of English, and the extent of speaking vocabulary as measured by the number of different words used. The inferiority of the bilingual group in oral reading accuracy and comprehension was found to be related to defective articulation.

2. There was no significant difference between the bilingual group and the monolingual group in silent reading vocabulary and comprehension, spelling, oral reading rate, number of words spoken per three minute period of time, clause length, degree of subordination, and complexity of sentence structure.

3. Fifty-two per cent of the bilingual children had articulation defects; whereas the percentage of the monolingual children with such problems was 14. When the articulatory defects were classified as to type of error, the bilingual children made more errors of substitution and the monolingual children more errors of distortion than any other type.

4. The bilingual children made 80 per cent more grammatical errors than the monolingual children. The main errors of the bilingual children were those involving the conjugation of verbs, the use of the correct preposition, and the correct choice and use of words.

The conclusion was drawn that the bilingual children were handicapped in some aspects of language, particularly those related to vocabulary and articulation. Results obtained suggested that the language difficulties of the bilingual children in this study were related to a paucity of linguistic and experiential stimuli to vocabulary development and the presence of confused and incorrect language and speech patterns in the home.

222 pages. \$2.78. Mic 56-628

**LUDICROUS CHARACTERIZATION IN AMERICAN
COMEDY FROM THE BEGINNING
UNTIL THE CIVIL WAR**

(Publication No. 15,367)

Stanley Leonard Glenn, Ph.D.
Stanford University, 1955

Until recently not too much importance has been placed either in American theatrical study or in the study of American literature upon the early drama of this country as contributing to or reflecting native thought. It is true that much of our early theatrical entertainment consisted of imported English plays and adaptations of French and German melodramas, and that a good majority of the original American plays could hardly be considered great drama. Nevertheless, a large number of original plays were written by Americans in the first seventy-five years of their country's development, and many of them reveal efforts to create a drama which might mirror native thought and the contemporary scene. The calibre of these plays has little bearing on their value as a possible key to the revelation of the development of American thought and character. This is particularly true of the comedies, whose attempted realism, contemporaneity, recognition of local types, and ridicule of human foibles might, if thoroughly investigated, provide us with a rich source in the study of the

development of our national character. Even if such an investigation only repeats what is already known concerning the development of the national character, it will serve to reinforce that knowledge, and reveal whether or not the theatre (in this instance, comedy) is capable of making a contribution to such knowledge.

This dissertation is primarily concerned with the study of ludicrous characters in American comedy from its inception until the Civil War. By an examination of the consistencies, changes, and developments of the ludicrous details of comic characterization, an attempt has been made to achieve the objective stated above. In order to accomplish this, the study has been divided into three parts, which parallel the interrelationship with the historical and dramaturgical development of the United States. The first period, entitled The Beginnings, extends from 1766 until 1812. The second period, called The Development, covers the years between 1812 and 1845. The final period, The Era of Social Comedy, begins in 1845 and concludes with the Civil War.

In order to analyze the numerous ludicrous characters in comedies from 1766 until 1860 in an organized manner, characters were first divided on the basis of sex and age, after which categories of character were established and discussed according to the source from which their foibles were derived. For example, local color types and foreigners were placed in the category of "Environment," because in most instances their ludicrous traits were a result of the speech and manners which were associated with their backgrounds.

This method made it possible to perceive the major tendencies and trends in ludicrous characterization, and to determine whether or not any consistency existed in the kinds of deviations with which comic characters were provided. The result revealed very definite patterns of development and change in the treatment of character which paralleled general trends in the growth of the American nationality.

Despite the development and the changes evidenced in comic types and subject matter, there was a unifying concept of character which lay at the source of almost all comic characterization. That concept was based on the Rousseau-romantic ideal of the innate goodness of man, and on the belief that man becomes corrupted by the artificial restraints and conventions of society, particularly one in which the emotions are distrusted, and where there is an excessive emphasis on reason. The ideal norm was the "natural" man who felt deeply, but might reason clearly, and who recognized that the true worth of a man lay in his instinct for virtue, in his ability, and in his desire for honest labor. Consequently, during the entire period of American comedy before the Civil War, the comic deviant almost invariably strayed from one extreme of this norm to the other. The Yankee and other local color types represented the cruder extreme of the "natural" man, while the fop, the foreigner, and other groups represented the extremes of over-refinement. In the earlier comedies, artifices and superficial ideals were blamed on aristocracy and its emphasis on title or rank; later, those who put an excessive value on money instead of character, and who attempted to form a monied aristocracy were deflated by the treatment of American comic dramatists.

519 pages. \$6.49. Mic 56-629

JOHN MORLEY AS CRITIC OF PUBLIC ADDRESS

(Publication No. 15,246)

Dwain Earl Moore, Ph.D.
University of Illinois, 1955

The study presents a systematic account of John Morley's criticism of speeches and speakers, draws together his concepts of the nature and function of public address, and examines his methods as a critic.

The sources used include the published works of Morley, especially his lives of Gladstone, Cobden, Walpole, Cromwell, and Burke; his critical essays; On Compromise; and Recollections.

Morley's remarks on public address are based upon his classical education, on his wide literary experience, and on his own extended practice and observation in oratory. In 1883, at the age of forty-five, he was elected to Parliament and shortly after became a member of Gladstone's cabinet. He continued in Parliament and for periods in the cabinet, until 1914. Thus he had ample opportunity for practice and observation of political speaking.

Chapter I reviews briefly his career and characterizes his own speaking and personality. Chapters II and III present his criticism of the oratory of Gladstone and Richard Cobden; Chapter IV his comments on Walpole, Cromwell, and Edmund Burke; and Chapter V his observations on other speakers, in Parliament, in other countries, in the pulpit, and on his own speaking. The final two chapters utilize his remarks on particular speakers and his general comments on speaking to indicate his theories of the nature and purpose of oratory and to describe his critical methods.

Morley's criticism is a scholarly blend of the biographical, historical, and critical methods. Although he seldom employs the vocabulary of professional critics, he presents a rather complete commentary on all four aspects of communication: the speaker, the speech setting, the speech, and its effect. His view of public address emphasizes the exercise of logical reasoning to forward practical truth and the dramatic conflict of speaking. The speaker's character emerges as the most vital element in communication.

In his criticism of Gladstone, Morley discusses all of the elements of the communicative situation, giving an intensive and extensive account of his training, his intellectual and physical qualities, his audiences, his arguments, the effects he produced. In commenting on Cobden, he details the agitator's breadth of general preparation, his debating skill, and the arguments and effects of the Free Trade campaign. The studies of Walpole and Cromwell are less detailed, but Walpole emerges as a business-like speaker and leader and Cromwell as a powerful debater whose words were without polish. Morley helped to raise his idol, Burke, to a high level of oratorical reputation, praising the literary quality of his oratory while judging his delivery to be deficient. His remarks on other orators present swift sketches of a number of the speakers of the nineteenth century. Throughout, he depicts vividly the dramatic interplay of historic forces bearing on the speech situation.

Morley conceives of rhetoric, the sister art of logic, as both a fine art and a useful one, whose aim is to communicate practical, probable truths. He distinguishes between public speaking and literature and recognizes oratory as a separate genre. He believes style to be the product of the speaker's character and makes no attempt to analyze

particular elements of expression. He is interested in a speaker's delivery in general, and particularly in the rhythm and flow of the human voice. He also recognizes that a speech will produce some effect on the immediate audience and that it will often have remote results.

Although he seldom uses the language or viewpoint of the professional rhetor, he offers valuable criticism compounded of contemporaneous reports, excerpts from speakers' journals, texts of speeches, and other results of his own research and observation of speaking occasions.

388 pages. \$4.85. Mic 56-630

A CASE STUDY OF ORAL COMMUNICATION PRACTICES OF FOREMEN AND ASSISTANT FOREMEN IN A MID-WESTERN CORPORATION

(Publication No. 14,421)

Darrell Thomas Piersol, Ph.D.
Purdue University, 1955

Major Professor: P. E. Lull

In an effort to increase our knowledge about the oral communication problems and activities of supervisors a limited case study of a Mid-Western Corporation was undertaken. Through the use of patterned interviews an attempt was made to find answers to the following questions:

1. What are the oral communication activities carried on within the company by foremen and assistant foremen?

2. What are the oral communication activities carried on for the company, outside of the plant, by the foremen and assistant foremen?

3. What are the oral communication activities carried on by the foremen and assistant foremen in individual interests and community service during off duty hours?

4. What are the attitudes of foremen and assistant foremen toward their oral communication tasks?

5. How much training in oral communication have the foremen and assistant foremen received in school, in company training programs, and in training outside of the plant?

6. Through what channels of communication do foremen and assistant foremen generally first hear about company policy, changes in regulations, or company lay-off of workers?

After analyzing the data obtained by the use of patterned interviews a method of personal observation was developed to find answers to the following questions:

1. How much of each foreman or assistant foreman's work day is spent talking and/or listening?

2. How much time does a foreman or assistant foreman spend in oral communication in the performance of various tasks and duties related to his job?

Sixteen supervisors served as subjects for this study. Each supervisor was interviewed intensively and observed on the job for two complete (8-hour) working days.

The general conclusions reached after all data from the patterned interviews had been analyzed are as follows:

1. The oral communication carried on within the company by foremen and assistant foremen included interviews, conferences, social conversations, and speeches.

a. A majority of the supervisors felt that they generally spent more time listening than talking in interviews with workers.

b. The supervisors indicated that they rarely gave a speech before any group during the work day.

2. The supervisors had very few oral communication activities representing the company in interviews, conferences, or speeches outside of the plant.

3. The oral communication activities carried on by the supervisors in the community after working hours consisted mainly of social conversation and interviews.

4. The foremen and assistant foremen felt that the majority of their communications "up," "down," and "horizontal" were oral.

a. The supervisors indicated that they thought that from ninety to ninety-five per cent of their daily communications were oral and from five to ten per cent of their communications were written.

b. The supervisors were divided in their opinions on the relative importance of oral and written communication.

c. A majority of the supervisors favored regular group meetings of the employees answerable to them.

5. The foremen and assistant foremen in this company had received a negligible amount of training in oral communication in school, outside of plant training, and in company training programs.

6. Half of the supervisors indicated that they generally heard about company policy, changes in regulations, or company lay-off of workers through rumors (grapevine) before they received the information through regular company channels.

The general conclusions reached after all data from the personal observation (shadow technique) had been analyzed are as follows:

1. Approximately fifty per cent (four hours) of a supervisor's work day was spent in some form of oral communication activity (speaking or listening).

2. The task category in which both foremen and assistant foremen spent most time in oral communication was in the maintaining of quality and quantity of production; foremen differed from the assistant foremen in the rank order of time spent in other task categories.

A further conclusion was that the findings obtained in the patterned interviews were largely substantiated by the direct observation method (shadow technique).

152 pages. \$1.90. Mic 56-631

BERNARD SHAW'S RHETORICAL DRAMA: A STUDY OF RHETORIC AND POETIC IN SELECTED PLAYS

(Publication No. 15,264)

Robert Lee Scott, Ph.D.
University of Illinois, 1955

Critics have long been aware of Bernard Shaw's unique purpose in writing drama. They have used a number of terms to indicate this purpose: rhetoric, homilies, thesis-drama, dialectics, propaganda, and others. But Shaw's critics have been content merely to label his drama or to set forth the implications of their conclusions in a general fashion. It is the purpose of this study to investigate the significance of the easily applied cliché that Shaw's drama is rhetorical.

The study is based on a general analysis of the playwright's approach to drama and from a specific analysis of some of his plays. In order to allow an intensive analysis, Man and Superman was chosen for detailed study. To give the study more scope, Shaw's invention of persuasive materials in John Bull's Other Island and Major Barbara was examined and compared to that of Man and Superman. This examination contains some references to other plays as well and is more general than the analysis of Man and Superman.

The general thesis of this study is that Bernard Shaw was governed by a specific persuasive purpose which led him to rhetorical expression in writing drama but that his rhetorical impulses were fused with poetic impulses. The result is neither rhetoric nor poetic but Shaw's own unique drama.

Shaw utilized drama to persuade; specifically, he wished to irritate his audience in order to bring them closer to acceptance of his ideas. His rhetorical impulses affected his drama. Character, plot, action, conflict, dialogue and stage direction all serve rhetorical as well as dramatic functions. Within the play, the characters fill the dialogue with argument which gives the drama logical, emotional, and ethical force. The emotional effects of the plays are too often underestimated. He used irritation, indignation, superiority, emulation, and humor to put his audience in "the proper frame of mind." Although there is a basic deductive relationship among the parts of the ever-present theses, the plays have a strong inductive impact. Shaw made his characters "moral examples" and worked them into his plots to make his plays grand inductions.

Even though Shaw wrote with a specific rhetorical purpose and made some definite efforts to appeal to his audience, he was at the same time a dramatic artist. His drama is not simply rhetorical. The introduction of ideas through the various characters not only presents his theses, but also brings about conflict which creates drama as well. This drama even has a poetic quality. An analysis of Shaw's style, especially, shows the concreteness, the emotion, and the uniqueness which are the hallmarks of poetic discourse.

Fundamentally, Shaw's drama arose out of his impulse to express certain ideas in a persuasive fashion. Underlying his drama are three general themes to which he returned again and again: socialism, natural morality, and life force. He not only made the drama serve rhetorical purposes, however; he also created drama through the use of rhetoric. The dramatic and the rhetorical have a reciprocal effect; each helps bring about the other. His aim was to appeal to the more intelligent theater-goers of his day and to increase the number of such patrons. Shaw insisted on what he felt to be a high type of drama, and even at the risk of limiting his audience, he maintained the integrity of his ideas. 333 pages. \$4.16. Mic 56-632

A RHETORICAL ANALYSIS OF THE SPIRITUAL EXERCISES OF IGNATIUS LOYOLA

(Publication No. 15,277)

George Thomas Tade, Ph.D.
University of Illinois, 1955

This thesis is a study of the Spiritual Exercises, a manual of self-persuasion written by Ignatius Loyola (1491-1556), the founder of the Society of Jesus.

This study represents an attempt to analyze the rhetorical aspects of the Spiritual Exercises in order to answer such questions as: (1) In what ways may the Spiritual Exercises be considered rhetorical? and (2) Do the rhetorical methods used in Loyola's system of self-persuasion reflect any special emphases or departures from the traditional application of rhetorical principles?

The procedure used was to examine the text of the Spiritual Exercises and the Directorium in Exercitia, a companion volume compiled by the later fathers, in order to ascertain what rhetorical methods were used in Loyola's system. The rhetorical aspects of the Exercises were then compared and contrasted with late medieval rhetorical theory and practice.

The findings of the study are as follows:

1. The Spiritual Exercises may be considered rhetorical in as much as they reflect the use of traditional rhetorical methods. The Exercises reveal the use of topics, the modes of persuasion, and a well-defined scheme of arrangement. Loyola appears to show concern for audience adaptation, and even oral communication finds its place in the Ignatian method. Two traditional aspects of rhetoric, style and delivery, play an insignificant part in Loyola's system.

2. The rhetorical principles revealed in the Exercises show three special emphases: (1) Ignatius employs the syllogism in logical proof. His concern is with arriving at universal rather than probable conclusions; therefore, his mode of logical proof is nearer that of dialectic than of rhetoric. This emphasis corresponds closely to the contemporaneous rhetorical theory of the high Middle Ages. (2) The Saint attached great importance to placing the exercitant in a state of mind receptive to God's grace; and he relied heavily upon methods of suggestion such as seclusion, darkness, penance, repetition, prayer, and the deliberate stimulation of the powers of the soul and of the senses. These methods of effecting the emotional mode of proof are, of course, not traditional in rhetorical theory; however, much the same emphasis and many of the same methods are found in late medieval preaching and the tracts on preaching. (3) Loyola shows a keen sense of audience as reflected in the many suggestions he proposes for the adaptation of the Exercises to various individuals and classes of men. The Saint's concern for audience adaptation was also an emphasis of late medieval rhetorical theory. 151 pages. \$1.89. Mic 56-633

SPEECH THERAPY

SOME DEVELOPMENTAL, PSYCHO-SOCIAL, AND EDUCATIONAL VARIABLES AMONG CHILDREN WITH NORMAL SPEECH AND CHILDREN WITH FUNCTIONAL ARTICULATION PROBLEMS

(Publication No. 15,033)

Ruth FitzSimons, Ed.D.

Boston University School of Education, 1955

1. The Approach to the Study

Purpose of the Study.—This descriptive study was predicated upon the construct of the study of the child as a "whole". Its purpose was to investigate some developmental, psycho-social, and educational variables among 140 first grade children. The sample was divided into two matched groups of 70 children who possessed normal speech and 70 children who possessed functional articulation problems. The members of the two groups were matched for chronological ages within four points, for intelligence quotients within five points, for sex, and for school locale within the city of Warwick, Rhode Island.

Methodology.—The sample was obtained by means of a speech screening test. The sample was screened for hearing acuity on a pure tone audiometer.

Historical case study information was secured by means of parental home interviews.

Examination data were secured by means of the following tests: 1. The Metropolitan Readiness Test. 2. The Kuhlmann-Anderson Intelligence Test, Sixth Edition, Book A. 3. The Metropolitan Achievement Test. 4. Read's Teacher Administered Rating Chart for Talks at the Primary Level. 5. The Children's Apperception Test. 6. The Vineland Social Maturity Scale.

Report card grades were secured from the cumulative record cards.

The discrete data were analyzed by means of the chi square test. The continuous data were analyzed by means of the T-test.

2. Results of the Study

Summary and Conclusions.—Some of the chi square tests produced significant results at the one per cent level, thus denying the null hypothesis of a lack of relationship between membership in the articulation group and the following attributes: 1. Age of weaning. 2. Age of occurrence of childhood diseases. 3. Age of walking. 4. Age of talking—in single words and in phrases. 5. Destructiveness.

6. Eating and food problems. 7. Nervousness. 8. Refusal to obey. 9. Showing off. 10. Shyness. 11. Temper tantrums. 12. Thumb sucking. 13. Unsatisfactory grade in language. 14. Unsatisfactory grades in work habits and in health habits. 15. Unsatisfactory grade placement in reading.

Other chi square tests produced significant results at only the five per cent level. These are: 1. Abnormal birth conditions. 2. Age of implementation and accomplishment of toilet training. 3. Jealousy. 4. Night-mares. 5. Fears. 6. Unsatisfactory report card grade in reading. 7. Unsatisfactory reading readiness status.

The T-tests showed that there were significant differences between the means of the articulation group and the normal group at the one per cent level of significance for the following variables: 1. Total number of childhood problems. 2. Total oral participation score (The mean total oral participation score of the normal group was significantly greater than that of the articulation group.) 3. Presence of perception of parental figures as authoritarian in the protocols of the C.A.T. 4. Presence of aggression in the protocols of the C.A.T. 5. Presence of fears and anxieties in the protocols of the C.A.T. 6. Presence of positive story out-comes in the protocols of the C.A.T. (The mean number of positive out-comes in the normal group was significantly greater than that of the articulation group.)

The articulation sample tended to: 1. wean earlier. 2. have illnesses during the period of language acquisition. 3. be delayed in locomotive and communicative attainments. 4. have more childhood problems. 5. achieve unsatisfactory grades in language, work habits, and health habits. 6. be poor achievers in reading as measured by report card grades and an achievement test. 7. have greater incidence of abnormal birth conditions. 8. have toilet training demands initiated earlier. 9. have lower reading readiness status. 10. have greater incidence of projection of C.A.T. themes which suggest emotional disturbance.

3. Implications of the Study for Speech Therapy

The findings of this research study suggest that a relationship exists between functional articulation disorders and psychological factors. Its findings tend to suggest that a functional articulation anomaly may be symptomatic of a psychological deficit within the child who has a functional articulation speech problem.

151 pages. \$1.89. Mic 56-634

ZOOLOGY

THE APPLICATION OF SOUND RECORDING TO MUSEUM NATURAL HISTORY EXHIBITS

(Publication No. 15,583)

Frances Lowell Burnett, Ph.D.
Cornell University, 1955

The aim of this project has been to investigate ways and means of making natural history exhibits more realistic and educational through the addition of sound recording and synchronized lighting; to promote the development of and procure suitable equipment to carry out this concept; to install this equipment in a museum and test it under actual museum working conditions for effectiveness, dependability, and practicability; to determine as objectively as possible the reaction of the public to such a presentation; and to investigate the possibility of adapting this type of equipment to portable loan exhibits sent out to schools by museums.

For the addition of sound to a museum exhibit, tape recording seems the most advantageous system to use in this connection. As in 1951 no relatively inexpensive tape mechanism was available, that could be started by remote control and stopped automatically at the end of the program, with a continuous flow of tape, it was part of the problem to promote the development of a suitable, low cost, tape mechanism for use with exhibits.

For the synchronized lighting, there were difficulties in devising an unfailing, yet simple, signaling device on the tape to operate a rotary stepping switch and assure perfect synchronization of the lighting with the sound program. A timer run by a synchronous motor has been found to accomplish the switching of the lights most satisfactorily.

Several experimental audio-visual exhibits were set up in connection with bird habitat groups in order to test the equipment. This equipment has proved to be practical and reasonably simple to install and maintain. Its dependability has been satisfactorily demonstrated by constant use at the Peabody Museum, Salem, Massachusetts. In this project, a Magne-loop Tape Recorder (Amplifier Corporation of America, New York City) operated for over fourteen months, and a Remote Control, Multi-cam Tiner (Industrial Timer Corporation, Newark, New Jersey) for two months. The equipment for a complete installation can be purchased at the present time (1955) for under \$400, and the operating costs are in the neighborhood of pennies per hour.

A study was made in which 232 questionnaires were handed out in connection with one exhibit to test the public reaction. Comments by the visitors showed almost unanimous approval. The educational value of this kind of an exhibit was shown by the fact that so many of the comments mentioned or implied "education."

While the addition of sound recording and synchronized lighting to permanent or semi-permanent museum natural history exhibits has proved to be successful, it was determined through interviews that it does not now seem practical to advocate the use of this system in connection with the portable loan cases sent out to schools by museums.

113 pages. \$1.41. Mic 56-635

A STUDY OF FACTORS THAT MAY CONTRIBUTE TO THE HOST SPECIFICITY AND FEEDING OF BLOOD SUCKING MITES

(Publication No. 15,297)

Hansell Flynn Cross, Ph.D.
University of Maryland, 1955

Supervisor: Dr. G. W. Wharton

Adults and nymphs of *Bdellonyssus bursa* (Berlese, 1888), the tropical fowl mite and *Bdellonyssus bacoti* (Hirst, 1913), the tropical rat mite were subjected to comparative feeding tests in an attempt to find a cause for their host specificity. *Laelaps echidninus* (Berlese, 1887), *Laelaps nuttali* (Hirst, 1915), *Haemolaelaps glasgowi* (Ewing, 1925), *Dermanyssus gallinae* (DeGeer, 1778) and *Bdellonyssus sylviarum* (Canestrini and Fanzago, 1877) were tested by the same techniques and methods for purposes of comparison.

Ten mites of each stage were tested in a small glass tube 3 inches by 0.25 inches. Heparinized blood was introduced into a rubber cylinder at one end of the tube. A small piece of silk cloth cemented to the inside surface of the cylinder prevented blood from seeping into the tube. The number of engorged mites was recorded after 30 minutes and this provided a means by which the different tests could be compared.

Approximately 2100 tests were run for all species of mites. They were tested under different conditions of temperature, humidity and on the blood and skin of different hosts.

A humidity of 83 - 96 per cent reduced the feeding of *B. bacoti* and *B. bursa*, but at 28 - 73 per cent the number of engorged mites was not significantly different from a control at 22 per cent. *Laelaps echidninus* and *H. glasgowi* fed more readily at a high humidity than the mites of the genus *Bdellonyssus* but the results with *L. nuttali* were inconsistent because of variability in feeding.

Bdellonyssus bacoti and *B. bursa* adults and nymphs had a higher feeding rate at 102-107° F. than at 110-115° F., 95-97° F., 85-97° F., 72-75° F. or 60-70° F. A decrease in temperature did not affect the feeding rate of adults of the genera *Laelaps* and *Haemolaelaps* as much as it did those of the genus *Bdellonyssus*; however, the nymphs of *L. nuttali* were as greatly affected.

The mites were tested on the whole blood, red cells, plasma and serum of the normal and abnormal host. *Bdellonyssus bacoti* fed least on plasma and *B. bursa* least on the red cells of both normal and abnormal blood. In survival tests, mites survived longer when fed serum than when fed on red cells, plasma or whole blood. The laelaptid mites fed equally well on the whole blood, red cells, plasma and serum.

The dermanyssid mites fed through the skin of the natural and unnatural host, whereas, the laelaptid mites were unable to feed through the skin. The laelaptid mites could feed on

abraded skin and all of the species fed more readily on blood than through the skin.

The difference in feeding of *B. bacoti* and *B. bursa* was not significantly different in the light or dark, but *L. echidninus* fed significantly more in the dark.

Blood was found to be the factor most concerned with host specificity, but other factors collectively, including the activity of the host, may be partially responsible.

179 pages. \$2.24. Mic 56-636

**A TAXONOMIC STUDY OF THE CYPRINID FISH
CLINOSTOMUS VANDOISULUS (VALENCIENNES)
IN THE EASTERN UNITED STATES**

(Publication No. 15,591)

Earl Edward Deubler, Jr., Ph.D.
Cornell University, 1955

Ichthyologists have long realized that *Clinostomus vandoisulus* exhibits considerable geographical variation in meristic and proportional characters; however, no complete study has determined the exact distributional pattern and the nature and significance of the geographical variation. In this study, geographical variation and distribution have been correlated in an attempt to gain a better insight into the pattern of speciation for the minnow.

Clinostomus vandoisulus is confined to that area of the United States east of the Mississippi River which is bounded approximately by the thirty-fourth and fortieth parallels of latitude. With the possible exceptions of the Cape Fear River in North Carolina and the Edisto River in South Carolina, it occurs in all major Atlantic Slope drainages from the Delaware River in southeastern Pennsylvania and western New Jersey to the Upper Savannah River in Georgia. West of the Appalachian Divide, the species is discontinuously distributed in tributaries of the Ohio River in West Virginia, Ohio, Kentucky, and Tennessee. It occurs in mountainous and piedmont habitats.

Over nineteen hundred specimens were examined throughout the range of the species. Thirty-two meristic and proportional characters were utilized. All data are presented as frequency distributions and characters which are diagnostic are presented in the form of significance diagrams.

The species is divisible into three distinct geographical subspecies. *Clinostomus vandoisulus vandoisulus* (Valenciennes) occupies the northern and eastern segments of the range, and is divisible into two races: the Eastern Race in the New River and Atlantic Slope drainages, and the Lower Ohio Race in the Scioto, Little Sandy, Big Sandy and Guyandot rivers. *Clinostomus vandoisulus estor* (Jordan and Brayton) is found in the Lower Tennessee, Duke and Cumberland rivers. A new subspecies, *Clinostomus vandoisulus* subsp., is diagnosed. It is apparently confined to the Little Tennessee River system in the Great Smokey Mountains of Tennessee and North Carolina.

Several meristic and proportional characters of the Eastern Race of *C. v. vandoisulus* tend to be clinal in a north to south direction for at least a part of its range.

C. vandoisulus was probably distributed throughout the eastern segments of the prehistoric Teays River system in preglacial times and apparently gained access to the

Tennessee and Cumberland rivers. A preadapted stock established itself in the Little Tennessee River where subsequent isolation of the population resulted in the differentiation of an undescribed subspecies. With the advent of the Pleistocene epoch, the northern portion of the Teays River was obliterated, and the population of *C. vandoisulus* in the Tennessee and Cumberland rivers was isolated from that in the remaining easterly segments of the Teays River. Subsequent to this isolation, the evolution of *C. v. vandoisulus* and *C. v. estor* presumably occurred. *C. v. vandoisulus* probably gained access to Atlantic Slope drainages by stream captures between the New and Roanoke or James rivers, or both. Its dispersal northward probably occurred during the Post Talbot Uplift when present day tributaries of the Chesapeake Bay drained into the Susquehanna River. Dispersal southward presumably occurred by headwater captures between adjacent river systems.

194 pages. \$2.43. Mic 56-637

**ECOLOGICAL ISOLATING MECHANISMS,
REPRODUCTIVE ISOLATING MECHANISMS AND
RELATIONSHIPS OF THE AVIAN GENERA
HYLOCICHLA AND *CATHARUS***

(Publication No. 15,592)

William Christopher Dilger, Ph.D.
Cornell University, 1955

This study deals with the nature of the ecological and reproductive isolating mechanisms displayed by species of the genera *Catharus* and *Hylocichla*; groups of largely sympatric, closely related forest thrushes. The species involved are: Wood Thrush, *Hylocichla mustelina*; Veery, *Catharus fuscescens*; Hermit Thrush, *C. guttatus*; Olive-backed Thrush, *C. ustulatus* and Grey-cheeked Thrush, *C. minimus*. These forms have a roughly allopatric distribution from south to north in the order given above although much overlap occurs; especially in mountainous areas. All are primarily ground foragers and have hind limb and bill proportions consistent with this behavior. Two species, however, show tendencies in the proportions of these structures toward a more arboreal adaptation. These two species, *fuscescens* and *ustulatus*, are apparently responding to selective pressures supplied mainly by their sympatric, ground foraging relatives. Competition for food is certainly reduced among these five species by the drifting toward arboreal adaptiveness by these two species, thus allowing more species to occupy a given area. Observations on their feeding habits lend further support to this conclusion. In addition, these forms are further separated by whether they forage mostly in the forest interior or at the forest edge. The Wood Thrush is a ground forager at "outside" edge situations along the margins of wooded areas while the Veery is an interior forager typically frequenting low shrubbery as well as the ground. The Hermit Thrush is a ground forager in "inside" edge situations, for example, along the edges of old burns, lakes and other smaller clearings within the forest itself and the Olive-backed Thrush is primarily an arboreal forager of the forest interior. The Grey-cheeked Thrush is a ground forager of forest interiors. Ecological isolation is principally achieved by alternating ground foraging, forest edge inhabiting forms with arboreal foraging, forest interior inhabiting forms.

Since these species are very closely related, especially the four species of *Catharus*, and are similar in appearance and habits but with no hybrids ever detected; an effort was made to determine the nature of their reproductive isolating mechanisms. Experiments, conducted with the aid of models of the various species and their recorded vocalizations indicate that none of the species can distinguish its own species by appearance alone. Vocalizations, especially the advertising songs, were found to be highly species specific and to serve as the principal source of sign stimuli in species recognition. These vocalizations, probably fortified by some attendant visual displays, differences in habitat, and some differential in breeding time serve as species specific characters tending to minimize or obviate the chances of mixed pairs being formed. These several patterns of behavior function as the interspecific isolating mechanisms in these genera.

The relationships within this group of thrushes has been subject to controversy as has their exact placement within the subfamily Turdinae. Anatomical considerations such as limb proportions and general size along with coloration, hostile displays and nest construction lead to the conclusion that the Wood Thrush (fortunately the type species of its genus) is best left in *Hylocichla* while the remaining four species should be considered congeneric with the South and Central American genus, *Catharus*. The subfamily Turdinae of the family Muscicapidae is popularly divided into two tribes; the chat-like thrushes, Saxicolini, and the true thrushes, Turdini. Certain features of the jaw musculature, osteology of the skull, shoulder musculature and general habits render it most likely that the genera *Hylocichla* and *Catharus* should be regarded as being members of the Turdini.

145 pages. \$1.81. Mic 56-638

EFFECTS OF PREDATION BY CORMORANTS AND GARS ON FISH POPULATIONS OF PONDS IN ILLINOIS

(Publication No. 15,201)

Leonard Durham, Ph.D.
University of Illinois, 1955

Double-crested cormorants (*Phalacrocorax auritus auritus*) and shortnose gars (*Lepisosteus platostomus*) were placed in small ponds so that the effects of these predators on the fish populations could be studied. Control ponds were also studied. Food habits of cormorants were observed in the laboratory and in the field in order to determine roughly their food requirements. The stomachs of 62 double-crested cormorants contained fish ranging in total length from 3.5 to 12.2 inches. Five cormorants in the laboratory ate an average of 0.9 pounds of fish per bird per day for 71 days.

The population of largemouth bass (*Micropterus salmoides*) in an experimental portion of a gravel-pit pond grew faster than bass in the control portion of the pond after 2 double-crested cormorants were kept in the experimental area for 14 days. The larger of the green sunfish (*Lepomis cyanellus*) in one pond were eliminated by cormorants. The green sunfish and goldfish (*Carassius auratus*) remaining in the pond increased in rate of growth after the predation by cormorants. The birds were on the

pond for a period equivalent to one cormorant for 202 days. The larger bluegills (*Lepomis macrochirus*) were eliminated from one pond after predation by one cormorant for 51 days and one American merganser (*Mergus merganser americanus*) for 14 days.

In five ponds stocked with shortnose gars as predators, bluegills increased in relative numbers, in Index of Condition, in rate of growth in certain age-classes, and in maximum lengths. In Control Pond which had no gar, bluegills constituted approximately the same percentage of the total fish population each year, did not increase in Index of Condition, maintained approximately the same rate of growth, and did not gain appreciably in maximum length.

Largemouth bass in the five experimental ponds showed a decrease in relative numbers in two ponds and no change in three ponds. The Index of Condition of bass in the ponds generally decreased. An increased rate of growth of bass occurred in the two- and/or three-year age-classes. Bass in Control Pond were relatively unchanged in numbers, in rate of growth, Index of Condition, and maximum length.

Green sunfish in one pond stocked with gars and in Control Pond gradually decreased in number, but at a faster rate in the pond with gars. Increases in rate of growth, condition, and maximum length of green sunfish occurred in Gar Pond but not in Control Pond.

Hybrid sunfish decreased greatly in number in Gar Pond but increased slightly in Control Pond. Increases in Index of Condition, in rate of growth, and maximum lengths of hybrids occurred in Gar Pond.

Black crappie (*Pomoxis nigromaculatus*) increased in number and in maximum lengths in three of four ponds. No definite changes in rate of growth of Index of Condition of crappies could be attributed to predation by gar.

On the basis of the above results, it appears that cormorants should be used as predators on fish populations on a short-term basis only. Shortnose gars appeared to be more practical for use in controlling fish populations than did cormorants. More testing of the stocking of gars in other situations should be done before any recommendations for their control of populations of stunted fish can be made.

117 pages. \$1.46. Mic 56-639

A PLAN FOR THE USE OF FACTUAL AND VISUAL MATERIAL IN TEACHING THE VERTEBRATE FAUNA OF IDAHO WITH EMPHASIS ON CONSERVATION

(Publication No. 15,488)

Herbert Hamilton Frost, Ph.D.
Cornell University, 1955

Chairman: Richard B. Fischer

Material on the vertebrate fauna of Idaho is scattered and is not well organized. The purpose of this study was to accumulate information concerning the vertebrates and their conservation and to make it available to high school biology teachers. It was felt that the material presented would enable teachers and students more objectively to understand the problems of the vertebrates and their conservation.

The physical features of Idaho are described along with material on the early explorers and their contributions to

a knowledge of the vertebrate fauna. Duties and functions of the education and information division of the State Fish and Game Department are given.

Sections are devoted to each of the following classes of vertebrates: fish, amphibians and reptiles, birds, and mammals. Each section includes information concerning the conservation activities of the State Fish and Game Department, a discussion of the families found in Idaho, problems concerning the vertebrates and their conservation, and a summary of the vertebrates reported from the State.

One hundred and seven families of vertebrates are reviewed briefly (16 fish, 16 amphibians and reptiles, 54 birds, and 21 mammals). Each family is briefly differentiated from similar families. Simple keys have been constructed to use in differentiating large groups within the families. General life history material is included.

Current and future conservation problems are discussed under each class of vertebrates. Some of these are: pollution, exotic species, fishing needs of the future, protection of birds of prey, and big game management.

Emphasis is placed on the types of field trips to be taken when studying the classes of vertebrates. The trips would vary from season to season and with the different classes of vertebrates. Inviting guests from the State Fish and Game Department and from like organizations is discussed as an important method of informing students of current conservation problems in the State and nation.

High school biology classes are suggested as a source for initiating conservation projects. These projects would be worked out in cooperation with the State Fish and Game Department, local fish and game clubs, or the United States Fish and Wildlife Service.

Recommendations and suggestions are given in areas where more study is needed. Types of studies that could be adequately carried on by high school students are suggested.

Source material, both technical and non-technical, is included to aid the teacher and the student. This material will enable teachers to select good books for their school libraries as well as to inform them in more detail on material covered in the various sections.

Summaries of the species of Idaho vertebrates are listed at the end of each section. These include scientific names, common names, and counties where the species have been found. In all, 490 forms are listed. These include 70 fishes, 38 amphibians and reptiles, 285 birds, and 97 mammals. 250 pages. \$3.13. Mic 56-640

THE EFFECTS OF PHYSICAL-CHEMICAL FACTORS ON THE QUANTITATIVE PRECIPITIN REACTION OF CHICKEN ANTISERA

(Publication No. 14,698)

Nazareth Gengozian, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Harold R. Wolfe

Part I. Effect of dilution of chicken antisera in the quantitative nitrogen test.

Dilution of chicken antiserum prior to its combination with antigen causes a marked decrease in the antibody

nitrogen titer. The objective of the present study was to determine the nature and cause of this dilution effect. Dilution studies were made on four chicken anti-bovine serum albumin sera, differing in their undiluted titers. Plotting the data (Ab N/ml vs. dilution level) on log-log graph paper made apparent a relationship in the dilution pattern of the four antisera, yielding straight line graphs with approximately the same slopes. Expression of the data in this manner afforded an analogy to the adsorption phenomenon of colloidal chemistry in which the Freundlich equation is often applied ($\log \frac{X}{M} = n \log c + \log K$). Empirical adaptation of this equation to the data obtained in this study resulted in a "Desorption Equation": $\log (Ab N^d) = n \log c + \log (Ab N^u)$, where $Ab N^d$ is the antibody nitrogen obtained per ml when the antiserum is diluted, $n = 0.27$ (the absolute value for the average of the slopes) c is the % of the initial concentration of the antiserum in the reaction mixture (dilution level) and $Ab N^u$ is the antibody nitrogen obtained per ml from the undiluted system. Application of this equation was fairly successful in predicting the dilution tiers for two antisera, and conversely, in predicting the undiluted titers from an observed dilution value.

Increase volume changes of the undiluted reaction mixtures gave results qualitatively similar to the dilution effect, indicating a high degree of dissociation of the antigen-antibody complex.

The dilution phenomenon is explained on the basis of multiple antibody types believed to be present in immune sera. The antigen molecule is visualized as a constant adsorbing unit, the variability in antibody precipitation being dependent upon the reactivity or avidity of antibody for the antigen molecule.

Part II. A quantitative study on the aging of chicken antisera with a consideration of the role of chicken complement.

Interfacial tests indicate an increase in titer upon aging of chicken antisera. The purpose of this study was to determine the effect on aging of antisera employing the quantitative nitrogen technic. Chicken antisera to bovine serum albumin were employed. The term "fresh" indicates the antiserum was tested on day of bleeding and "aged" indicates it was stored at 4° C or frozen for at least one week. Results obtained on the aging of chicken antisera were as follows: (1) A significant decrease in nitrogen precipitation occurred when quantitative determinations were performed in 8% NaCl. (2) Interfacial tests using 1.8% NaCl showed an increase in antibody titer. (3) Quantitative nitrogen determinations made with 1% NaCl resulted in an increased nitrogen precipitation, particularly in the antigen excess region of the curve.

Quantitative studies on chicken complement show the following: (1) Decomplementation decreases markedly the precipitation in the antigen excess region of the curve. This is evident in both the 1% and 8% NaCl systems. (2) Decomplementation of chicken antisera by versene is to be preferred to decomplementation by heat, since non-specific co-precipitation is incurred by the latter method when the quantitative test is performed in 8% NaCl.

Explanation for the increased precipitation after aging was based on the fact that with a 1% saline concentration the inherent antibody content of chicken antiserum is never realized. Therefore any factor which may contribute to the insolubility of antigen-antibody complexes known to be present in the system will cause the increased precipitation observed. In the 8% quantitative test the decrease in

precipitation observed after aging is not due to a loss or destruction of complement but to elimination of other serum protein constituents.

91 pages. \$1.14. Mic 56-641

**A SYSTEMATIC STUDY OF THE CYPRINID FISHES
BELONGING TO THE SUBGENUS CYPRINELLA
OF THE GENUS NOTROPIS**

(Publication No. 15,596)

Robert Henry Gibbs, Jr., Ph.D.
Cornell University, 1955

In the large and diverse genus Notropis, one of the most clearly recognizable groups is the subgenus Cyprinella. In spite of the relative similarity of the species, however, their generic status has been confused, and conversely, their similarity has resulted in specific misidentification. More than fifty specific names have been applied to the members of the subgenus, and they have been included in no less than fourteen genera or subgenera. The major cause of both the generic and specific vacillation has been the variability of the forms, the unwise use of which has resulted in unnatural subdividing. The present study attempts to define the subgenus Cyprinella, to elucidate its patterns of variation, to delineate and properly describe the species and their subdivisions, and to consider the dispersal and evolution of the group.

Although many generic names have been applied to the species of Cyprinella, only Codoma, Cyprinella, and Moniana, proposed by Girard in 1856, need be considered. Hubbs and Ortenburger recognized in 1929 that the type species of Cyprinella and Moniana were the same species, and in the same year Jordan merged the two genera. In this study, the proposal is made that Codoma, the only presently recognized member of which is the type species, ornatus, also be included in Cyprinella.

Counts and measurements were made on more than 6,000 specimens of Cyprinella, and many thousands more were critically examined, but not included in statistical analyses. This does not include Notropis lutrensis, proserpinus, or ornata, or other species closely related to these. Fifteen species are recognized, and several subspecies are retained or newly described as follows:

| | |
|--|--|
| <u>pyrrhomelas pyrrhomelas</u> (Cope) | <u>spilopterus spilopterus</u> (Cope) |
| <u>pyrrhomelas</u> new sub- species | <u>spilopterus</u> new subspecies |
| <u>xaenurus</u> (Jordan) | <u>venustus venustus</u> (Girard) |
| <u>callistius</u> (Jordan) | <u>venustus cercostigma</u> (Cope) |
| <u>niveus niveus</u> (Cope) | <u>venustus stigmaturus</u> (Jordan) |
| <u>niveus</u> new subspecies | <u>galacturus</u> (Cope) |
| <u>callisema</u> (Jordan) | <u>camurus</u> (Jordan and Meek) |
| new species Bailey and Gibbs MS. | <u>whipplei</u> (Girard) |
| <u>leedsi</u> Fowler | <u>analostanus analostanus</u> (Girard) |
| <u>trichroistius</u> (Jordan and Gilbert) | <u>analostanus chloristius</u> (Jordan and Brayton) |
| <u>caeruleus</u> (Jordan) | |

The ancestral stock of Cyprinella presumably inhabited the Tennessee River system and possessed diamond-shaped scales, strongly concentrated pigment in the last two

dorsal fin membranes, and breeding tubercles which were arranged in linear rows on the head, notal ridge, and caudal peduncle.

An early transfer to southeastern river systems gave rise to a major evolutionary line, which developed an inferior mouth. This was dispersed and its range split by barriers, resulting in the complex of species which includes callistius, niveus, callisema, leedsi, and a new species being described by Reeve M. Bailey and the author.

At nearly the same time, a more northerly capture isolated a stock in the Atlantic coastal drainage which probably dispersed southward and then had intervening populations wiped out to leave pyrrhomelas in the Santee and Pee Dee rivers and xaenurus in the Altamaha; pyrrhomelas most nearly retains the ancestral characters of Cyprinella.

While the tubercle pattern was still linear, the Alabama system received another stock from the Tennessee which gave rise to trichroistius.

The remaining forms were all derived after the linear tubercle pattern had been lost or obscured and now display a scattered arrangement of these excrescences. Three major lines evolved.

A form with depigmented caudal base developed in the Tennessee and spread across the Mississippi into the Arkansas River. Speciation occurred on either side of the Mississippi, resulting in galacturus and camurus. N. galacturus has since reinvaded the West, and camurus is found in Mississippi.

Notropis spilopterus stock from the Mississippi Valley gave rise to the Gulf coast venustus and probably to caeruleus in the Alabama.

Notropis whipplei, from a center in the Mississippi Valley, crossed the Appalachians and gave rise to analostanus on the Atlantic slope. 282 pages. \$3.53. Mic 56-642

**LIFE HISTORY STUDIES ON HYDROMERMIS
CONTORTA (KOHN), A NEMATODE PARASITE
OF CHIRONOMUS PLUMOSUS (L.)**

(Publication No. 15,230)

Arthur Albin Johnson, Ph.D.
University of Illinois, 1955

The nematode Hydromermis contorta, previously only accounted for in Europe, has been found in a number of midwestern eutrophic lakes in the United States. Douglas Lake, Michigan; Crystal Lake, Illinois; and Lukens Lake, Indiana, have yielded the worm in very small quantities while Lake Manitou, Indiana, has a high population in at least one of the depressions. The nematodes are parasitic in Chironomus plumosus larvae.

The form designated Paramermis contorta by Kohn (1905), Hagmeier (1912), Svabenik (1928), and Comas (1927, 1928) has been returned to the genus Hydromermis as Daday (1912) suggested, since it does not fit into the genus Paramermis as it was originally described. Further evidence that the Paramermis contorta of von Linstow (1889) and that of Kohn (1905) are not the same was supplied by Corti (1907) who observed both forms.

In life history the American form basically parallels the European form as far as is known although the European

form that has been investigated was found in *Chironomus thummi* in comparatively shallow water in ditches. The American form was found in *Chironomus plumosus* in a lake depression at a depth of 20 to 26 feet. Two parasitic generations occur each year in the American form. The first begins in November and terminates in late January, while the second is initiated in late February and persists until May. The fate of the nematodes from the middle of May until November is unknown.

A comparison of the European form and the American form of *Hydromermis contorta* shows the American form to be somewhat larger. Qualitatively, the better development of the dorsal commissure in the American form, the slight difference in the anterior ends, and the increase in the number of anal papillae in the American form distinguish the two forms.

Most nematode larvae are differentiated with the exceptions of the reproductive systems before they enter the definitive host. Development of *Hydromermis contorta* is not merely a growth of already differentiated parts, but is also a differentiation of many parts. This is especially true of the stichosome which increases considerably in cell number and appearance. Meissner (1854) showed this to be the case also in *Hexamermis albicans*. Evidence is presented for cell division occurring in a somatic structure after the nematode has hatched from the egg.

The sex ratio of the American *Hydromermis contorta* is 3.35:1 of males to females. This is dependent on the number of nematodes in the host, a low number producing females and a high number producing males. It is calculated that about one-sixteenth of the population are zygotically irrevocable females, while one-eighth of the worms are zygotically irrevocable males. The other thirteen-sixteenths of the population can be either sexually mature males or females depending on their environment.

The effect which the nematodes have on the hosts is quite marked, even in cases which macroscopically do not appear infected. Every organ system with the exception of the nervous system is reduced in size, even at the cellular level. The most marked reduction occurs in the fat bodies which disappear completely in the host. Ultimately the host dies, but usually only after emergence of the parasite. The cause of death is probably mainly the loss of hemocoelic fluid although the diminution of the body parts possibly due to starvation could be a contributing factor.

The presence of flagellated sperm is also noted. Meissner (1954) observed these in *Hexamermis albicans*, but it is generally assumed, incorrectly, that mermithids possess amoeboid sperm. 98 pages. \$1.23. Mic 56-644

A COMPARATIVE MORPHOLOGICAL STUDY ON THE NERVOUS SYSTEM OF THREE ORDERS OF CESTODES

(Publication No. 15,233)

Richard Joseph Lacey, Ph.D.
University of Illinois, 1955

The morphology of the nervous system of seven species of cestodes was studied in this work. The following tapeworms were included:

Schistocephalus sp.

Diphyllbothrium sp. plerocercoid

Triaenophorus sp. plerocercoid

Bothriocephalus sp.

Trypanorhynchoidea, plerocercus larva.

Taenia pisiformis

Thysanosoma actinoides

The nervous system of the pseudophyllidean forms examined consists basically of two longitudinal nerve cords, running the length of the strobila, that are connected by a transverse median commissure in the scolex. In *Schistocephalus* sp. fourteen pairs of accessory nerves are present in the most anterior proglottids. The other three pseudophyllidean forms had nerves arising from the longitudinal cords in the scolex that proceed to the bothria. In *Triaenophorus* sp., additional nerves continue anteriorly from the level of the commissure and appear to supply the muscular attachments of the hooks. The commissure structure in *Bothriocephalus* sp. is ring-like in nature with a dorso-ventral median connection.

The nervous system of the one trypanorhynchid examined agreed with the basic plan established for this group.

In the cyclophyllidean forms, the nervous system in the strobila consists of ten longitudinal cords, two dorsal, two ventral, and three on each lateral margin. These nerve cords are connected at the posterior margin of each segment by a ring commissure. In *Thysanosoma actinoides*, a broad nerve arises from the main longitudinal cord and proceeds to the posterior lateral margins of the proglottid. The nerve cords are connected in the scolex by a series of commissures. A posterior, polygonal commissure unites all the nerve cords. A transverse median commissure joins the two main lateral nerves. Another commissure unites the nerves that continue into the apical region. In *Taenia pisiformis*, this commissure is at the base of the rostellum and gives off nerve branches that apparently supply the muscular attachments of the hooks of the rostellum.

No evidence of a subcuticular plexus of nerve fibers was found. Nerve cells were found only in the transverse median commissure. In general, the nervous system of the pseudophyllidian forms appeared to be the most primitive of the three groups studied. 65 pages. \$1.00. Mic 56-645

EXPERIMENTAL STUDIES OF FITNESS AS MEASURED BY VULNERABILITY TO PREDATION

(Publication No. 14,726)

Archie Stanton Mossman, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor John T. Emlen

Experiments on predation selectivity in relation to the "physical fitness" of the prey were conducted utilizing known predator and prey populations. Fish served as predators on other fish, birds as predators upon birds, and mammals as predators on birds and mammals.

Usually about half of the prey animals present were chosen randomly and hampered in some manner. The relative vulnerabilities of hampered and normal animals were then tested. In general, the hampered animals were more vulnerable than the normal controls although some exceptions did occur.

Fish species possessing stout spines were made more vulnerable by removal of their spines than by removal of their main propulsive fins. On the other hand, fish lacking spines suffered a marked decrease in viability under predation after their caudal fins had been cut off.

When certain flight feathers were clipped from the wings of House sparrows (*Passer domesticus*) their vulnerability was increased. Screech owls (*Otus asio*) were able to take normal sparrows with some success and, as a result, their predation was less strictly confined to the definitely subnormal sparrows than was that of the Red-tailed hawk (*Buteo jamaicensis*). It was concluded that efficient predators probably are much more important than inefficient ones in the control of disease and in the evolutionary selection of prey species.

A loss in the selectivity of predation occurred during two experiments when cover was added. If the addition of cover was indeed responsible, this confirms tentative deductions based on general observation and theory.

Immature or weak birds were more vulnerable than adult or strong ones. It was also found that among those prey animals whose sex was known, females were somewhat less vulnerable than males, however the hampering techniques appeared to affect females more than males.

The relationship between cover, disturbance and predation is discussed in the light of observations made in the experiments and in the light of published records, with the conclusion that increasing disturbance of the prey should increase its vulnerability. A corollary of this relationship seems to be that predator pressure should rise faster than the number of predators, especially where a variety of predators occurs.

Fitness is defined as the level of adaptation of an organism or group of organisms to its environment. In this study, fitness has been measured by testing the vulnerability of organisms to predation. Similarly cover should be measured in relation to its ability to provide the functions expected of it, such as concealment for stalking predators or protection from predation. The term "prey protective cover" has been coined to cover the latter more effectively than the somewhat restrictive term "escape cover".

Prey and predator density in relation to predation selectivity is briefly considered.

Movement by a raptor was found to greatly facilitate its recognition by English sparrows. Movement may even be essential for predator recognition. Prey movements seem to act as sign stimuli for predators that are visual feeders. The movements made by a sparrow unable to gain altitude were especially potent in releasing attack by the hawk or owls.

Food storage by predators is discussed briefly emphasizing food caching by owls.

Cyclic and eruptive behavior of animal populations is discussed and it is suggested that such phenomena may be allowed by the failure of predation to prevent prey increases. Some mechanisms of predation that help determine the amount of predator pressure are discussed. Using this information as a background it is hypothesized that cycles and eruptions should be least violent in complicated ecosystems and most violent in uncomplicated ecosystems (weather excepted). Field observations described in the literature seem to support this hypothesis.

134 pages. \$1.68. Mic 56-646

A STUDY OF DDT RESISTANCE IN THE COLORADO POTATO BEETLE, *LEPTINOTARSA DECEMLINEATA*, SAY.

(Publication No. 15,424)

Richard John Quinton, Ph.D.
Cornell University, 1955

This study deals with the manifestation of DDT resistance in the Colorado potato beetle. The field aspects of the problem relate to investigations with a series of insecticides intended to provide information on the use of effective materials for commercial control of this insect. This work, and related laboratory determinations, indicated that endrin, isodrin, dieldrin and heptachlor were superior materials for the control of both adults and larvae of DDT resistant populations. LD50 values were determined by converting mortality data by probit transformation methods. In stomach action tests, endrin, dieldrin and heptachlor were superior to DDT by ratios of 1:378, 1:120 and 1:24 respectively. Owing to the level of resistance, contact tests with DDT and methoxychlor did not provide sufficient data for determining interpolated LD50 values.

In order to conduct the laboratory work, a constant supply of both larvae and adults were needed throughout the year. This necessitated continuous rearing of the insect; and the methods and equipment used are discussed.

The laboratory phase was intended to reveal any correlation between lipid values and susceptibility to DDT which might result in populations reared on different host material. Because variations in growth and development proved too extreme in larvae reared on Solanaceous material other than *S. tuberosum*, this plant was used exclusively as the host in this work. Host variation was subsequently considered as a function of age within the potato plant.

Using topical application methods, the contact action of DDT was determined for fourth instar larvae. These insects were reared on young potato foliage and were from the second generation of a DDT field resistant strain. The probit transformation of mortality data provided an LD50 value corresponding to a dose of 0.4425 mg. of DDT per larva. Subsequent determinations were not made due to the negative results obtained in the lipid tests.

The related lipid investigations were conducted on fourth instar larvae reared on potato foliage of the following age groups: 1-2 weeks, blossom stage and 2-3 months. Fresh and dry weights were recorded and the dried, pulverized sample was extracted in a Soxhlet apparatus. Ether and chloroform were used in sequence as solvents. The lipid fractions soluble in these materials were recorded and the related per cent dry weight values computed. These determinations were quantitative and when treated by analysis of variance methods, showed no significant differences at the 5% level due to host effect. There were also no significant differences in the ratios of these lipid values as determined on the several hosts.

The results indicate that the age of the potato plant does not represent a biological factor which, through changing nutritional values, effects the quantitative aspect of lipids in fourth instar Colorado potato beetle larvae. This evidence would not seem, however, to negate the lipid hypothesis as it may relate to this insect.

108 pages. \$1.35. Mic 56-647

**ECOLOGY AND OCEANOGRAPHY OF
THE CORAL REEF TRACT,
ABACO ISLAND, BAHAMAS**

(Publication No. 15,431)

John Frederick Storr, Ph.D.
Cornell University, 1955

This study is concerned with a concentrated examination of animal inhabitants, physical environment and the relation between the two throughout a mile transect of the coral reef tract extending from the shore to the main line of reef. A lesser concentrated study was made of the reef material seaward of the main reef to the cessation of coral growth at the fifty foot depth.

Light-weight diving equipment was used in the study with the modification or designing of measuring apparatus for underwater use.

The Abaco reef is developing on a gently sloping bottom seaward of a line of small cays. These cays or islands are the remains of an ancient bioherm covered by lithified calcareous sand. A shallow but wide lagoon exists between the line of cays and Abaco Island proper.

Seaward of the main reef the coral structures form isolated masses termed "boilers" which rise to within a few feet of the surface. The "boilers" are usually cavernous, these caverns being inhabited by larger adult reef fish.

The main reef forms an almost continuous barrier 12 to 18 feet thick and over 150 feet wide. Between the main reef and the shore are a series of five lines of reef.

The bottom between the reef structures is composed primarily of sediments derived from the breakdown of the coral boilers and the main reef. The sediment size grades from coral chunks just landward of the main reef to medium sand grains at the inner part of the transect.

Throughout the summer months the water at the landward end of the transect was 1° C cooler on the average than the water at the main reef. The cooling of the shore water is a local Bahamian phenomenon caused by evaporation from the porous islands which allow water to ebb and flow through their rock.

The light at a 50 foot depth underwater in winter is about 1.1% of the summer surface light. The 50 foot depth is probably the compensation point for the symbiotic zooxanthellae within the coral polyps. Light thus becomes the limiting factor in the existence of coral growth with depth.

Wave thrust is the controlling factor in the growth of several of the principal reef corals. The gradient in the wave thrust from the main reef to the shore results in gradients in coral types and concentration, sediment size, bottom animal population, etc.

A distribution count of the animals and plants in a 24 foot width across the main reef and each of the inner lines of reef together with measurements of the physical environment and general observation made possible a separation of the reef into bio-physical zones, these are:

- (1) Sea Fan - Surf Zone.
- (2) Montastrea - Deep Water Zone.
- (3) Acropora palmata - Active Water Zone.
- (4) Porites - Moderate Wave Action Zone.
- (5) Echinoid - Low Wave Action Zone.

Zone 5 includes four phases.

- (a) Black Sea Urchin - Reef Phase.
- (b) Codakia - Thalassia Grass Phase.
- (c) Sand Dollar - Fine Sand Phase.
- (d) Cake Sponge - Bar Bottom Phase.

The lagoon area is also separated into zones and phases on a purely observational basis.

A discussion of the food chain as found on the reef; the effects of storms on the reef animals; the role of underwater sound in the ecology of the fish and other reef inhabitants is also made.

From the study a definition of the fringing reef (or near-fringe), as found in a zone marginal for coral growth, has been made: Such a reef must be entirely self-developed and possess an almost continuous outer or main reef. The outer reef must not be dependent upon any geological phenomenon such as a pre-existing submarine ridge for its development. The reef should possess a Sea Fan Zone, an Acropora Zone, a Porites Zone, and an Echinoid Zone (or zones similar to them) in that order. The landward edge of the reef area may be a land mass, a submarine ridge or the edge of a shoaling bank; the possession of an almost continuous self-built outer reef and sequential zonation being the prime requisites. The term fringing reef would imply the inclusion of all the sediments originating from the biota of the reef as well as the solid ridges or lines of reef proper.

335 pages. \$4.19. Mic 56-648

**HISTOCHEMICAL AND BIOCHEMICAL STUDIES
OF LIVER GLYCOGEN IN THE VESPERTILIONID
BAT, *Myotis lucifugus lucifugus***

(Publication No. 15,435)

John Robert Troyer, Ph.D.
Cornell University, 1955

Liver glycogen of female vespertilionid bats, *Myotis lucifugus lucifugus*, was studied by biochemical and histochemical methods in normal bats throughout the year, and in bats under the influence of experimentally altered temperatures, adrenalectomy, and alloxan administration, for the purpose of making comparisons between the different stages of activity in the yearly cycle and recording the effects of the experimental conditions on liver glycogen during hibernation.

All animals were killed by immersion in dry ice and acetone solution unless blood sugar determinations were performed, in which case it was necessary to kill the animals by ether. Liver glycogen was determined biochemically by the anthrone method and histochemically by the periodic acid Schiff method of McManus. Blood sugars were determined by the micro-method of Folin-Malmros. Pancreatic islet tissue of the alloxanized animals was stained with aldehyde fuchsin to reveal beta cell granules.

The results show a steady decline in liver glycogen content throughout the annual cycle, from a maximum during the first month of hibernation, to a minimum in the last month of the active period. An increase in fat deposition and body weight was observed during the month prior to hibernation, and body weights generally were directly correlated with the liver glycogen levels throughout the yearly cycle. The mean blood sugar levels of hibernating bats did not differ significantly from those of active ether-killed, but these levels were not believed to be valid blood sugar levels for hibernating bats. Liver glycogen levels were lower in bats maintained at room temperature than in normal hibernating bats or bats which had been returned to the cold-room after being maintained at room temperature.

The blood sugar levels were higher in bats maintained at room temperature than in bats returned to the cold-room. Liver glycogen and blood sugar levels of hibernating bats decreased markedly after the animals had been bilaterally adrenalectomized. Adrenalectomized bats subjected to room temperatures had less liver glycogen and blood sugar than did adrenalectomized bats maintained in the cold-room. Liver glycogen and blood sugar levels were lower in a few alloxanized bats than in the control animals, but these results are inconclusive. Generally, glycogen was uniformly distributed in the hepatic lobules of animals with high liver glycogen content. A decrease in the quantity of liver glycogen was usually evidenced by a disappearance of glycogen from the lobule center. There was never a greater concentration of glycogen in the central, than in the peripheral zone of the lobule. The beta cell granules of the pancreatic islets of alloxanized bats stained less distinctly than did those of the control animals.

In conclusion, liver glycogen content is highest in the first month of hibernation, but declines, through utilization, during the dormant period. It is unknown whether the decrease results from the slow utilization of the original glycogen stores, or if it owes to a more rapid utilization of the original glycogen stores which are being partially replenished by glycconeogenesis. The lower levels of glycogen in active bats undoubtedly are associated with a greater activity, and correspondingly greater expenditure of energy, than that found in hibernating animals. It is postulated that increased temperatures indirectly induce an increased carbohydrate metabolism which results in a decrease in liver glycogen in the bat. Glyconeogenesis is suggested by the partial restoration of liver glycogen levels in bats which were returned to the cold-room. The adrenal glands are necessary for maintaining the liver glycogen and blood sugar levels of hibernating animals. No consistent effect of alloxan on the distribution of glycogen in the hibernating bat was found. 114 pages. \$1.43. Mic 56-649

CALCIUM OXALATE CRYSTALS IN THE CUTICLE OF INSECT LARVAE, WITH SPECIAL REFERENCE TO *ANISOTA SENATORIA* (A. & S.) (LEPIDOPTERA)

(Publication No. 14,750)

Andrew Albert Weaver, Ph.D.
The University of Wisconsin, 1955

Supervisor: Associate Professor Lemuel A. Fraser

A study has been made of the occurrence, formation, and possible significance of calcium oxalate crystals in the cuticle of insect larvae, with special reference to the lepidopteran, *Anisota senatoria*. The integument of fifth instar *Anisota senatoria* larvae comprises a single layer of epidermal cells and a cuticle which is raised into a tubercle over each cell. The cuticle consists of a tanned epicuticle (2-3 μ), an untanned exocuticle (10 μ), and a thick endocuticle (60 μ). Two layers (cuticulin layer and paraffin layer) of the epicuticle have been demonstrated. The wax layer and cement layer may also be present but have not been demonstrated. Just beneath the epicuticle, embedded in the exocuticle, is found a layer of cubical crystals of cal-

cium oxalate. These crystals appear during the formation of the cuticle.

The first signs of the formation of the fifth instar cuticle are the pulling away of the epidermis from the old cuticle and the enlargement of the epidermal nuclei, both of which occur 24 hours before ecdysis. The deposition of the fifth instar cuticle begins soon after this. In the 12 hours before ecdysis, impregnation of the exocuticle takes place, tanning of the epicuticle begins at the tips of the tubercles, and pigment is deposited. Three to six hours before ecdysis the calcium oxalate crystals first appear. The crystals increase in number and more than double in size during the first day after ecdysis. By 3 days after ecdysis they have attained their maximum size (2.5 x 2 μ in surface view). The crystal layer is shed with the exuvium at the molt.

In all instars of *A. senatoria* larvae the calcium oxalate crystals are absent from heavily tanned areas such as the head, prolegs, spines, and muscle insertions. They are also absent from the linings of the fore-gut, hind-gut, and tracheae. Crystals are present in the cuticle of first instar larvae at the time they emerge from the egg. The yolk of eggs containing well-developed embryos contains curious dumbbell-shaped crystals of calcium oxalate which are apparently produced by the developing embryo. No crystals are found in the cuticle of pupae or adults.

Determinations of the percentage of ash in the cuticle of fifth instar *A. senatoria* larvae indicate an increase in the amount of ash which parallels the increase in size of the calcium oxalate crystals. The percentage of ash in the fully formed fifth instar cuticle is higher (5.3 per cent) than in most other lepidopterous larvae (0.2-1.5 per cent). The percentage of ash in the exuviae of the five instars varies from 18.3-25.8 per cent. Since this ash is almost entirely calcium from the calcium oxalate layer, an attempt was made to evaluate the role of exuvial calcium excretion in the over-all calcium excretion of the larva. Preliminary studies indicate that exuvial excretion of calcium accounts for a minimum of 2.1 per cent of the total calcium excretion in the fifth instar and 5.2 per cent in the fourth instar. The percentage of calcium excreted in the exuvium is actually higher than these minimum values, probably about three times as high. In the earlier instars an even greater role may be played by the exuvium in calcium excretion.

A survey of 146 species of immature insects in eleven orders revealed twelve species (eleven Lepidoptera, one Hymenoptera) with calcium oxalate crystals in the cuticle. Each of the five species of *Anisota* (*A. senatoria*, *A. stigma*, *A. virginensis*, *A. consularis*, and *A. rubicunda*) examined has a layer of cubical crystals. Five sphingid caterpillars also have crystals. Those of *Ceratomia catalpae* are rectangular plates embedded in the exocuticle. The crystals of *Phlegethontius sexta* and *P. quinquemaculatus* are also embedded in the exocuticle, but are long narrow prisms. The shorter prisms of *Sphinx chersis* are found throughout the procuticle, while those of *Smerinthus* are located near the surface of the procuticle. The crystals of *Polygonia interrogationis*, a nymphalid, are also short prisms located near the surface of the procuticle. The hymenopteran leaf miner, *Fenusa pusilla*, has a layer of crystals very similar to that of larvae of the genus *Anisota*.

109 pages. \$1.36. Mic 56-650

COMPARATIVE OSTEOLOGY OF SERRANID FISHES
OF THE GENUS MORONE (MITCHILL) AND
INFRA-SPECIFIC VARIATION IN MORONE
AMERICANUS (GMELIN)

(Publication No. 15,536)

William Starnold Woolcott, Jr., Ph.D.
Cornell University, 1955

The genus Morone occurs between parallels 50°N and 25°N and is represented by six species: saxatilis (Walbaum), chrysops (Rafinesque), americanus (Gmelin) and interruptus (Gill) in North America and labrax (Linnaeus) and punctatus (Bloch) in Europe. These species were formerly assigned to as many as five genera by authors. Berg (1949, *Fresh-water Fishes of the USSR and Adjoining Countries*) relegated them to a single genus Morone with three subgenera and based his classification primarily on external characters. The present osteological study, undertaken to check the validity of his conclusions, compared five species (punctatus excepted).

Preserved specimens were x-rayed, cleared and stained while others were cleaned by insects. The skeletal parts which showed greatest species differences were supraoccipital crest, otic (prootic, basioccipital and exoccipital), vomerine tooth plate and preopercle. Although smaller differences were noted in both the skull and trunk skeleton, in many cases where species differences occurred intermediate forms were found. Except for americanus and interruptus the species were readily separated using osteological characters. The findings strongly support the monogeneric classification of Berg, but both osteological and external characters are needed to properly define subgenera.

A study of the variation pattern in americanus was made

to determine whether various populations differed and if so on what level. The variation pattern was compared with that of saxatilis which occurs sympatrically over a part of the range.

Counts of fin rays and scales and measurements of various body parts were made on over 1,400 specimens. The data are presented as frequency distributions and in some instances significance diagrams are presented.

In americanus there appear to be two primary gene pools located north and south of the Delaware River. Evidence for this was found in anal ray and lateral-line scale counts which were higher in the north. Almost all measurements (expressed as percentage of standard length) were greater in the south. The Delaware River population is intermediate in many characters and appears to have drawn from both northern and southern gene pools. Partially isolated populations within the two major gene pools have diverged on a low level. Some differences are probably due to selective adaptation while others may be the result of phenotypic response to environmental influence. In lake populations the specimens were more elongate than were those from rivers. Many and often pronounced differences occurred in the composite sample from the Croton and West Branch Reservoirs which separate it from all other stocks including its parent stock in the Hudson River from which it has been separated by dams for less than 100 years.

The variation pattern in americanus is considerably different than that of saxatilis. For example in americanus fin-ray counts were generally higher in the Hudson River and lower in Chesapeake Bay tributaries whereas in saxatilis the reverse is true. The difference in the pattern of variation in these related species lends support to the belief that many differences between populations within each species may be genetic rather than due to environmental influence.

100 pages. \$1.25. Mic 56-651

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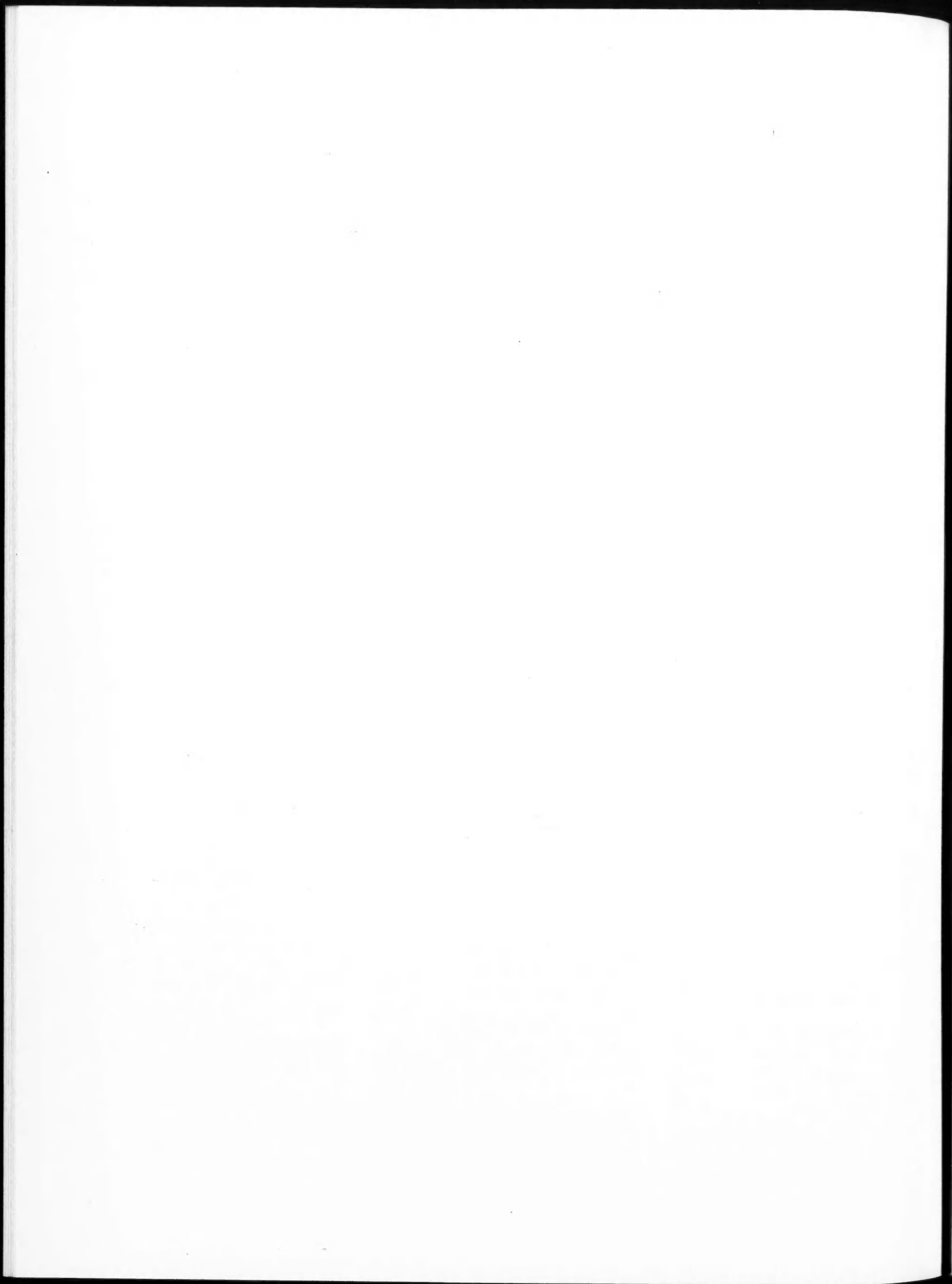
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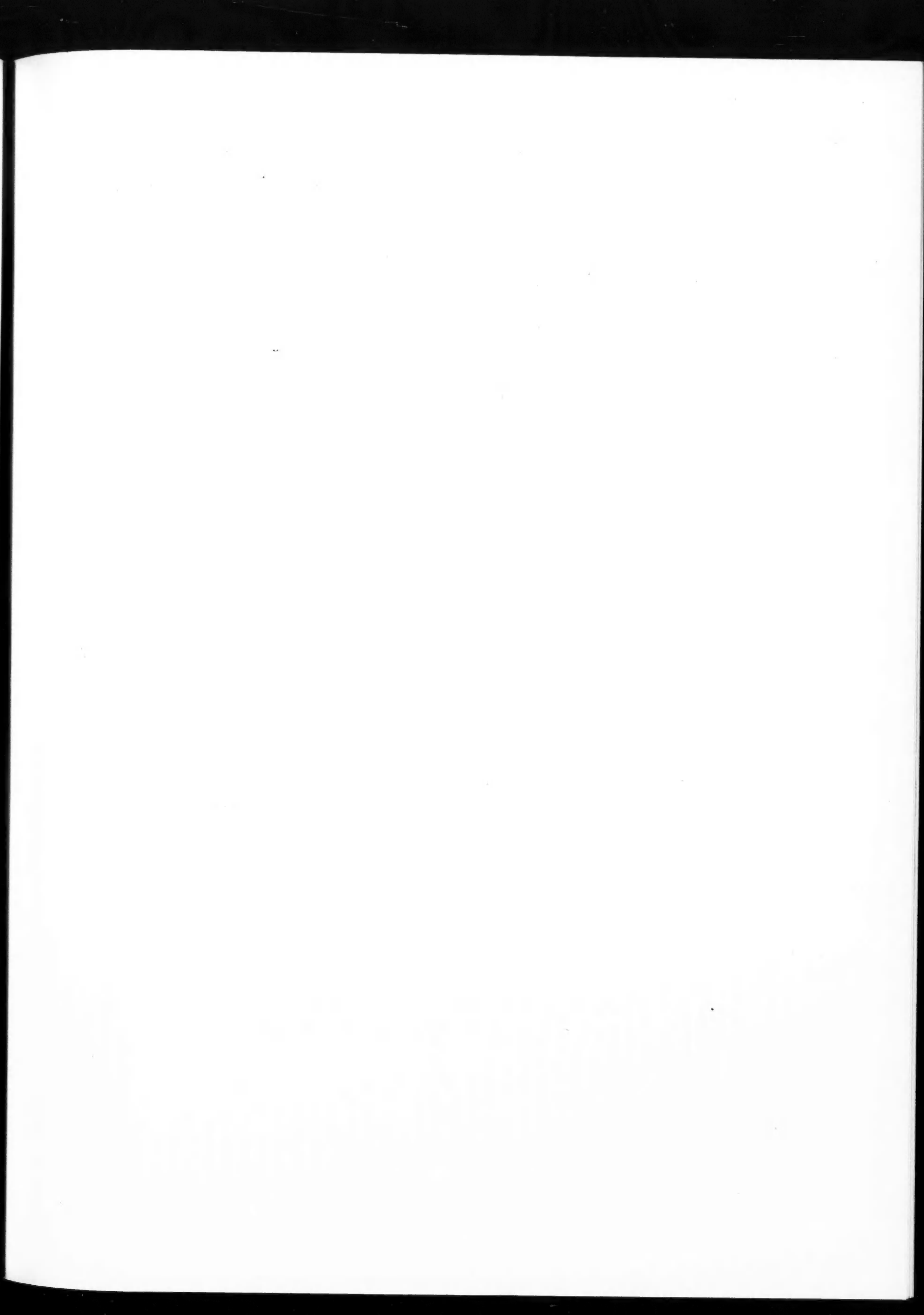
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